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LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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EDITORIAL NOTES.

At the Junction of Old with New Practices.

ALMOST with feelings of regret, we came across an apology at the end of the Presidential Address that Mr. R. Nelson, of Hull, delivered at last Saturday's meeting of the North of England Gas Managers' Association. He apologized for its omnifarious character, when we could have wished for more. The address diverts our thoughts for a space from the subjugating influences of the war. For this alone we are grateful to the President; for the subject-matter of his address, extensively varied though it is, we are more so. It takes us back to an appreciation of the fact that, though the difficulties and problems of wartime are so engrossing, after all our strength present and future lies in our practices, and that these practices must be governed by our economic circumstances, and not by mere fancy or aught else that does not contribute materially to trading stability and power. Towards the end of the address there was just a glance at certain polemical questions of the day; and welcome is given to Mr. Nelson as a professed adherent to the right of gas capital to a fair earning power, to the claim for a truly representative organization for the gas industry, and to fair controlled prices for secondary products during the war. And looking so far as he is able beyond the war clouds, he sees the dearness of money, materials, and labour, and therefore, to counter these drawbacks, the need of perfect freedom in making the best possible use of the industry's internal resources.

Though Mr. Nelson almost *in toto* limited his address to his own practices, studies, and research, they have a large bearing on subjects that to-day occupy attention with an eye to improving the status of gas in service and in competition with other agents for light, heat, and power. And in these respects, we cannot have too much research where it has an attached practical value, nor too much experience. In passing, there must be congratulation to the East Hull Gas Company upon its wartime price of gas, which in 1915 was 2s. and 2s. 3d., and in 1916 2s. 3d. to 2s. 6d. Though, too, in these two years there was a decrease in the consumption of gas compared with 1914, the volume sold was above that of 1912, and the number of consumers was increasing in total and per mile of main, which is of good augury, as is also the fact that there is a large field for the development of the cooking business in the difference between the 2103 cookers on hire and the 12,681 consumers that are connected to the mains.

However, one part of the address that has a contemporary appropriateness is where Mr. Nelson treats of matters affecting the life and working of intermittent vertical retorts, an installation of which was erected at the East Hull works in 1911, while last year and this year the beds have been reset. Vertical retorts with steaming as a means of dilution, and yet producing a gas of good combustible properties, have been lately brought into prominence; and, as Mr. Nelson has been practising two-hour steaming at the latter part of his twelve-hour charges, there is added interest in the evidence that he submits on the question of the maintenance of vertical retorts, which has often been considered as being something prohibitive (without taking full account of other charges), although evidence has been frequently, though perhaps only incidentally, adduced to the contrary. Mr. Nelson gives a table showing the periods that the five beds were "lighted-up" and "let down," with an indication of the repairs necessitated before the resetting. The working days' record of the life of retort-settings is not altogether a satisfactory one; we very much prefer the ton basis of life comparison, as this furnishes the actual work the retorts have done. In the record as to the periods of use of the five settings as given in the address, it is seen that, as between the working days of Nos. 1 and 4 beds, there is a difference of 563 working days—1361, compared with 1924. This is a considerable difference for beds that presumably had structural equality. But no explanation is given in regard to it; and so it may be taken that resetting convenience is partly responsible. The average ton-life, on the other hand, of beds Nos. 1 to 3 was 19,773 tons per bed; and the cost of re-setting was equal to 4·09d. per ton of coal carbonized. But, in considering this cost figure, due allowance must be made for the extra war cost of both materials and labour in 1916. The average ton-life of beds 4 and 5 was 23,403 tons per bed; and the cost of re-setting was equal to 4·04d. per ton, with materials and labour at this year's high values. It would have been interesting if comparison could have been made with machine-worked horizontals; but as hand-worked horizontals were the predecessors of the verticals, one must be content with the comparison with them. The average ton-life of the horizontals was 7000 tons; and the cost of re-setting was 2·66d. per ton. This, however, was at pre-war prices; so that the actual difference between them and the verticals would not, in respect of re-setting charges per ton, have been great, if the prices for materials and labour had been comparable. From the address, again, it is observed that repairs and maintenance of the vertical settings were of small character; and when it is seen that the average charges for repairs and maintenance of works and plant during the five years before the introduction of the verticals was 2·41d. per 1000 c.ft., compared with 2·51d. (including war prices) in the five years following the introduction of verticals, with all their mechanically operated plant, it is clear that there is nothing to complain about in respect of the maintenance costs of the verticals, even when contrasted with hand-worked horizontals. And when it is remarked that carbonizing wages with the latter amounted to 3·66d. per 1000 c.ft. on the average of five years, against 1·53d. with the verticals (including part horizontal working during each winter, and wartime charges), there is ample evidence to silence those critics who have not the personal experience and data with which to back their condemnation of vertical working. Throughout the address there are a number of incidental matters of interest to gas enginners in regard to practice and constructional details that we must here pass by.

Among work done other than the resetting of the vertical retorts has been the incorporation with the settings of special tar arrangements; and these have since been adopted at several other works. By the plan, the dip-pipes can be sealed and unsealed, and the amount of the seal varied at will. Though the description would lead one to imagine that there is an elaborateness about the arrangement, it is, as a matter of fact, perfectly simple, and has given satisfaction from the time of its introduction. It is the practice to work with the dip-pipes unsealed, except while actually charging and discharging verticals; and the results are the same as those claimed by engineers with long experience of a similar method in horizontal retort operation. The working conditions are rendered easier. There is no back-pressure in the retorts, and no backing-up of tar and liquor in the hydraulic main—the result being greater efficiency all round, with an increased make of gas. One of the tabulated statements shows that last half year 15,676 c.ft. of gas were produced per ton of coal carbonized—"coal gas

"only," it is said. But we rather think that this description should be modified, inasmuch as (as has been intimated) steaming is practised during the last two hours of the twelve-hour charge. It would be interesting to know the calorific value of the gas represented by the 15,676 c.ft. per ton of coal, as the calorific value of 531 B.Th.U. given in the table is for "mixed" gas, which means coal gas, steaming, and carburetted water gas—true, only comparatively lightly carburetted, seeing that only 1·31 gallons of oil are used per 1000 c.ft. The calorific value is excellent. The price charged for the gas (as previously mentioned) is low. Considering these things, considering, too, the make per ton of 15,676 c.ft., and later on the table treating of the nitrogen content of gas, we have here a contribution of no mean importance to the question of the economy to undertaking and consumers alike of legitimate dilution.

Relating to this matter, Mr. Nelson makes a suggestion. Though he has proved that yields considerably over the figures given, and of good calorific value, are possible with prolonged steaming, he is not sure about upsetting his two hours' steaming practice. He has his doubts as to the effect upon the retorts and upon the stability of the coke. Experience on these points is not great. Still there has been experimental work, but we question whether of sufficient extent to give anything definite regarding the former point, though engineers deny any appreciable effect on the coke. This, too, requires confirmatory work before positively accepting observations from short-period trials. It would be interesting if Mr. Nelson would go further into these matters, so as to compare with the work Mr. J. E. Blundell has been doing at Macclesfield, where we know he has, with continuous verticals and the alteration of the *locus in quo* of the highest temperature zone in his retorts, of late been getting 17,000 c.ft. per ton with steaming. The suggestion Mr. Nelson makes is one that he and others would like to see tried. It is the introduction at the bottom of the retorts of blue water gas *preheated to the retort temperature*, and in sufficient volume to keep the retorts swept from all coal gas as quickly as the latter is produced—particularly during the first three or four hours of the carbonizing period. The preheating to the retort temperature means an added process; but, nevertheless, if any compensating effects are obtainable, then it would be justified. The introduction of steam at the latter part of the period of the charge is, of course, a different thing from the introduction of cold blue water gas. The latter would in a measure be detrimental to the retort temperatures, especially at the early part of the carbonization period; and this would have a retarding effect upon the carbonizing work.

There is a close relationship between this part of the address and the later one dealing with the quantity of nitrogen in gas. There is full agreement with the President that we should, when considering the question of nitrogen, take into account not only the nitrogen in the gas, but the nitrogen in the amount of air required for combustion. At the same time, the greater the percentage of nitrogen in the gas, the greater the amount in any given mixture; and therefore the larger the quantity of heat extracted by it from the flame—causing heat wastage through the products of combustion. The amount of air needed for combustion depends upon the constitution of the gas; so that composition is also a matter that bears upon the percentage of nitrogen in the mixture. The data given in the tabulated statement are a very useful contribution to the question; but it must be borne in mind that they are calculated from an analysis of the various gases, and are not actual measurements. Nevertheless, the table is certainly of striking interest. For example, it is seen that blue water gas of only 306 B.Th.U. gives a flame intensity of 3490° Fahr.; while coal gas of 586 B.Th.U. only gives a flame intensity of 3280° Fahr. These figures are very impressive in their divergence as to calorific power, with the lower calorific power gas the superior in flame intensity. In the lower calorific power gas, there was only 3·7 p.ct. of nitrogen, and in the higher calorific power gas (these are only two gases out of a number brought into the tabulated tale) 5·36 p.ct., which is low. But for the lower calorific power gas, the air needed was only 2·26 c.ft. per cubic foot of gas, while with the higher calorific power gas it was 4·71 c.ft. A curious point is the marked uniformity shown by the table in the total nitrogen in the combustible mixtures, despite the distinct variations in the amount of nitrogen in the gases—variations, running up to 17 and 18 p.ct. The highest percentages are found in the lowest calorific power coal gases, or the mixed coal and carburetted water gases; and these are the gases (excluding the lower calorific power blue water gas) that showed the highest percentage of nitrogen in the combustible mixture per 100 B.Th.U., and that gave the lowest flame intensities. We take it that the vertical coal gas in the table is coal gas combined with steaming. It would have been interesting had the President included a mixed coal and blue water gas. However, his deductions from the calculated data are worth study.

It is true that, apart from theoretical considerations, in practice mechanical and physical conditions at the point of combustion are important contributors to flame temperature as well as the gas consumed. But in saying this, it must not be taken by any who have been selling large percentages of useless and flame-temperature damaging gases to their consumers that the fact in any way helps to condone the practice. The nitrogen figures that Mr. Nelson quotes in his table are nothing like the percentages of inert constituents that have been found in the opening crusade against their avoidable inclusion in town gas, which crusade we hope will find its end in the investigations that are now being made by the Fuel Research Committee and the Joint Committee of the Institution of Gas Engineers and the Leeds University. Among the lessons that are to be picked out of this table is one for advocates of higher calorific values. They will note the progressive rise in the calorific value in the first column of the table; and then they may cast their eyes down the fluctuating flame intensity figures in the last column. There is proof here that calorifiic power is not a very substantial criterion as to the real value of any gas.

Pipe Temperatures and Deposit Troubles with Intermittent Verticals.

The troubles there have been with vertical retorts, both intermittent and continuous, have been unduly magnified in some quarters, as though they were not surmountable by engineering talent. The magnifying of the troubles has not always come from disinterested quarters. It would be a grave reflection upon the capabilities of gas engineers if they could not overcome difficulties arising from details of carbonizing systems that have proved themselves possessed of certain very genuine advantages—if not of advantages that are so much ahead of horizontal working that they would put the latter very much in the shade. As is well known, horizontal retorts have maintained a rate of advance in economic operation and production that has been a very decided check to the progress in application of the vertical system.

However, among incidental troubles there have been with vertical retorts have been the pitching-up of the hydraulic mains and ammonium chloride stoppages; and there has been an amount of speculation as to the causes. The solution was not far to seek. The troubles have been experienced at the Meadow Lane Gas-Works of the Leeds Corporation; and how they have been overcome was related in a paper read by Mr. Harold A. Collett, at the meeting of the North of England Gas Managers' Association last Saturday. The particular troubles referred to are largely traceable to gas temperature; and the temperature of the gas is very much due to the area and length of the gas take-off pipes. In the intermittent type of vertical retorts, a retrograde step was taken, which set up these particular difficulties. In the earlier forms of settings of tens, they were non-existent. Each retort had its own 6-in. take-off pipe; and there was no pitching-up or ammonium chloride stoppages. With the new design of bed, only six 6-in. take-off pipes were provided for eighteen retorts, which are only about 4 p.ct. smaller than those in the settings of tens. The result was a reduction of 66 p.ct. in cross sectional area of the pipes to deal with an increased quantity of gas amounting to 55 p.ct. The pipes being too small and overworked, there came the pitching-up and ammonium chloride troubles. Reciprocating agitators were tried in the hydraulic mains; but the blades of these simply got converted into solid masses of pitch. In fact, even if successful, they would only be remedies for the results of a defect, without doing anything to get at the root of the difficulty, and effect the cure there. Moreover, troubles of the kind mean undue stoppages for cleaning; and a reduction of the producing capacity of the retorts.

Partial relief can be secured by tar circulation in the hydraulic, and the passing of a stream of liquor into the

foul mains. The latter will relieve from the chloride stoppages. But, as will be seen from the paper, tar circulation is not an unmixed blessing, and so was abandoned; and Nelson tar-towers were fitted at the end of each hydraulic main—a liquor circulation being substituted. Further alleviation was found by altering from two eight-hour shifts to three eight-hour shifts, so that the draws could be made every four hours; and the resulting charging of the retorts at regular and equal intervals had the effect of lowering the general temperature of the gas, with a consequent reduction of the chloride stoppages. All these expedients are useful; but still they do not touch the root of the trouble. The real improvement was effected when, in constructing a second bench, larger take-off and up-take pipes were adopted, with Leech and Payne's patent hydraulic main. At the same time, dip-pipes were abolished, and a tar-tower of the Nelson type was fitted at the end of each main for flushing purposes. The foul main was raised 12 ft., and increased in diameter to 24 in. The structural details will be found in the paper. But the main point about all these changes is that the superficial area of radiating surface in the various pipes was increased, and the gas temperatures so reduced by atmospheric cooling. The agitators have also been removed. The lower gas temperatures and the regular flushing of the mains and cleaning of the chambers in the patent hydraulic main have affected the cure. The clearing of the pipes from the deposits is now much easier, and, owing to the increased size of the pipes and mains, there is never more than $\frac{1}{2}$-10th difference in vacuum between the inlet of the governor and the retort, while in the portion of the foul main along the bench there is actually a pressure of 1-10th. Simple adjustment of parts to work has resulted in a transfer from trouble to a condition of almost monotonous regularity of working. Mr. Collett considers that there is still room for improvement in the methods of taking the gas away from the retorts, and that this will lead to better results. Summed up, the paper is a valuable contribution to the information available as to how to avoid troubles in intermittent verticals by proper attention to detail in design.

Fire-Bricks without Burning—Standard Tests for Refractory Material.

Those who know Dr. J. W. Mellor best are well aware that he is far from being a visionary—that in all his scientific work he has in view a definite and practical end, and that his suggestions have in them some element that he believes can be beneficially materialized. Therefore, if there is a proneness to scepticism on the part of readers towards a suggestion that he advances in the course of his paper on "The Testing of Refractory Materials," read last week before the Ceramic Society, let the knowledge of Dr. Mellor himself and of his prior work assist to mitigate that scepticism. He suggests the possibility, from an investigation into old-time research and actual work on a limited scale, and from the appreciation of theoretical considerations, of manufacturing fire-bricks without kiln-firing, but simply treating them to high pressures. "Madness" and the "rankest heresy," he apparently anticipates will be the descriptions applied to the proposal. Nevertheless, he is prepared to himself make an experimental trial should the necessary funds be forthcoming. The idea, in his opinion, justifies the expenditure of a few thousand pounds. So here is a good sporting chance for the refractory material making and using industries doing some good for themselves, if they will get into communication with Dr. Mellor on the subject of his requirements in this direction. He must not, however, expect that the notion is going to be immediately accepted. Refractory-employing manufacturers who would be most benefited will in all probability at first look askance at the idea, seeing that they have for a long time been asking for fire-clay materials to be fired at higher and higher temperatures; and pressure without firing is more than they will be able to swallow at a single gulp. But later, as the idea grows upon them, they may begin to wonder whether there is really something in it, including a reduction of cost of manufacture; and then they may think that the speculation of a few thousands may do good—anyway, it cannot do harm in settling something of which Dr. Mellor has the temerity to say: "I will be reckless enough "to predict that the result would be successful with the "aluminous types of fire-clay, although I do not think it "would be successful in making silica bricks without a "rather more elaborate preliminary treatment of the raw "material than would be needed with normal fire-clays. "Even here, however, I believe the cost of the preliminary "treatment would still keep the total cost of manufacture "less than that which is involved in the present method "of manufacture." There we have a predicted economy; and when consideration is given to the cost of refractory materials to the industries requiring them, any prospect of a reduction of cost, providing the economy is not accompanied by a *per contra* shortening of life, is alluring. We shall not be alone in the hope that Dr. Mellor will have the opportunity of putting the proposal to adequate test, and seeing whether those incipient experiments of fifty years ago and since are capable of development, as theoretical considerations justify the expectation that they are. Whether the Government Department for Scientific and Industrial Research would care to interest themselves in such an investigation cannot be said; but we see no reason why they should not.

So far we have only touched upon the tail-end of Dr. Mellor's paper before referring to its capital object, which was to emphasize the importance of standardizing the methods of conducting tests of refractory materials. We have known refractory materials submitted to two different laboratories that have shown remarkably divergent results, due entirely to variation in the methods of conducting the tests. This should not be; and in the work that is now shaping itself for a full investigation of the requirements of different industries in respect of refractory materials, it should be an indispensable preliminary to any attempt at specification to standardize the methods of testing, and for users to make it clearly known that they will not accept materials that are not subject to the standard methods of testing. According to Dr. Mellor, at the present time the seller naturally requires to have his tests made at a laboratory which gives the highest results; the buyer at one which gives the lowest results. There is some truth in this; but it is not all buyers who take the trouble to have laboratory tests made of the fire-clay material they buy. And those who do not have tests made as a rule show a magnificent confidence in the results of the tests submitted to them by manufacturers, as attested by the laboratory at which the tests were made. In such a case, the buyer who does not happen to know much about these things accepts the tests which present the highest results. Some of the points that should be included in the standard of test methods are discussed in the paper; and the case made clear for their observance. For example, the rate of the rise of temperature in the test should be specified—for very good reasons.

The importance can be readily appreciated by merely mentioning that the range of temperature is wider with aluminous fire-bricks than with siliceous ones. Again, one may take two fire-bricks with a difference of 150° in their squatting temperature on a slowly rising temperature, but which will appear to be equally refractory on a rapidly rising temperature. Still further, the softening temperature of a refractory for one rate of rise of temperature does not correspond with the softening temperature determined for another rate of rise of temperature. The importance of such points as these appears to have been lost sight of rather too generally; and therefore, to secure comparable tests, the rate of rise of temperature must be standardized. Other matters discussed are definite temperatures *versus* seger cones, and the size of the test-piece. There is also the question of conducting tests in an oxidizing or reducing atmosphere, which is a matter that was strongly brought forward on more than one occasion by Mr. W. B. Randall, of Waltham Cross—once particularly on the presentation of the Refractory Material Committee's report at the Institution of Gas Engineers. Bricks are usually fired in an oxidizing atmosphere, but are frequently used in a reducing atmosphere. Dr. Mellor concedes that tests should naturally be conducted under reducing conditions. The objection to the reducing atmosphere is that the reduction of the iron sometimes takes a long time; and it is then difficult to get constant and comparable results. Among the work that is now being done for the Institution is in regard to the behaviour of refractories under load; and Dr. Mellor makes brief allusion to the difficulties of standardizing such a test. However, the importance of standardizing the general methods of testing of refractory materials does not require much accentuation, if the desire is to obtain reliable and comparable results, and not results of which we do not know the true value or meaning, because of the uncertainty as to the lines of the methods followed in the testing.

Coal Factors' Charges.

It cannot be said that the result was particularly satisfactory of the deputation from the National Gas Council to the Coal Controller on the question of the charges that coal factors are to be allowed to put on the price of coal, and respecting other questions touching coal quality and contracts. From the official report of the deputation—which gives the minimum possible information, but probably all that is worth knowing—it is seen that the Coal Controller was sympathetic. We have rarely known a deputation that has not been sympathetically received by the chief of a Government Department; but, somehow or other, all the sympathy in the world does not, without action, help much in such material matters as coal prices and ash in coal. The rates of commission to coal factors and merchants, the deputation were informed, are "maximum" ones. This is not very consoling. The maximum in the case of railway companies is 3d. per ton; in the case of munition works, 6d.; and in the case of gas and electricity undertakings 9d.—that is to say, while the factors and the merchants are only allowed 3d. from the railway companies, they are to get no less than 9d. from gas undertakings. And there are gas men who want to know why gas undertakings should be charged three times more than railway companies; and why the commission should not have greater proximity to a fair average figure. The coal factors and the merchants are hardly likely to forego any part of the commission that has been given official ratification. With that ratification upon it, the coal factor who charges 9d. per ton commission cannot usefully be charged with exacting "an excessive rate;" but our readers will observe that any case brought to the Coal Controller's notice of a factor or merchant charging an excessive rate will receive his prompt attention. As the sanctioned 9d. will not be officially recognized as "excessive," it will not be much good drawing the Coal Controller's notice to the fact that some other people think that it is.

Ash in Coal.

There is the question of ash in coal. The Coal Controller will deal with specific complaints lodged with him. This, however, is a matter that requires to be treated not on specific complaints, but in regard to coal generally, inasmuch as the dirty condition of coal to-day is causing uneconomy throughout the land, and adding considerably to the railway ton-miles on which the Coal Controller bases his calculations as to the effect of his coal redistribution scheme. Concerning the explanation given in the report as to the reason for the cancellation of present contracts (with deliveries uninterrupted) being the revision of prices to make them conform with the Price of Coal (Limitation) Act, the question now is what is going to happen in connection with the increase of the miners' wages. Will the Coal Controller have to further revise prices, if (the point was mentioned in our first editorial article last week) the coalowners are allowed an increase upon the standard 4s. excess? The "Iron and Coal Trades Review" says it is considered that a further 2s. or 2s. 6d. per ton advance on the 4s. standard is inevitable. Bearing upon what has been said above, our contemporary appears to have more sympathy for the coal proprietor than for the coal factor and merchant. "Recently," it says, "the factor and merchant have been making a much larger profit than the colliery proprietor." Therefore we suppose this is considered a good reason why the colliery owner should now receive a further addition whether or not it is warranted.

Blue Water Gas Experiences.

There are practical experiences that should be brought to the notice of the Board of Fuel Research, and should be regarded by them as being as important as the results obtained from research carefully conducted in special plant. An excellent contribution to such practical experience could be supplied by Mr. Thomas Glover, of Norwich, who has been giving satisfaction to his consumers with a mixture of gas containing 25 p.ct. of blue water gas; the gas being, with the exception of the unavoidable quantity of inerts, of good combustible quality. Among more or less important subjects touched upon in the discussion at the Eastern Counties Association recent meeting on the President's (Mr. J. H. Brearley's) "opening" on war-time experiences, Mr. W. W. Townsend, of Colchester, mentioned the work he has been successfully doing in the same direction. In going to Colchester, he has taken over hand-fired carbonizing plant, and is making about 11,000 c.ft. of gas per ton. With this he has been using an amount of blue water gas equalling 25 p.ct. of the total mixture, and so making 14,600 c.ft. The calorific value is about 530 B.Th.U. gross. This has been going on for several months; and the consumers, who are accustomed to good gas, are quite satisfied. Experiences of this kind, as previously remarked, are of great practical value, and should not be overlooked by the Board of Fuel Research.

A Comparison that was not Justified.

Not only a large amount of ingenuity, but a great deal of thought and study have been expended by Mr. A. C. Ionides, jun., on devising and perfecting what he calls his pressure-balance, but which is more appropriately termed a mixture-balance, and which allows of the safe burning of an explosive mixture in a burner of more or less simple construction. In other words, it enables a mixture of any combustible gas to be made with the right amount of air to burn properly—the mixture being independent of any chance variations in the rate of the supply of gas. Information was given regarding the system in the inventor's paper read before the Metal Institute [published a fortnight ago]. Mr. Ionides is very enthusiastic over the performances of his own child; but his enthusiasm had a little water thrown on it in the course of the discussion—chiefly owing to an assumption he made that the performances of his system are far in favourable excess of what other workers have accomplished. The discussion is a sufficient comment on the claims regarding furnace work. In the course of the discussion, however, Mr. J. G. Clark was somewhat incensed over an assertion made by the author that he (Mr. Clark) had stated that the highest candle power obtainable at ordinary pressures in these days by incandescent lighting is 22 c.p. per c.ft. of gas. Those present who knew anything of the performances of the several types of incandescent burners and lamps were well aware that 22 candles falls considerably short of the highest efficiency realizable. Mr. Ionides seems to have obtained his information from a paper read by Mr. Clark in April, 1915. The diagram accompanying that paper shows curves for various burners and lamps in order to graphically demonstrate progress; and four of the curves refer to lamps without any accessory apparatus. But Mr. Ionides' mixture-balance is an accessory; and therefore it would have been fairer had he compared it with a lamp of special construction designed for securing a higher duty per cubic foot. Inventors and makers have not been asleep since 1915; and so, when we have freedom in lighting again, we shall see further developments to the credit of gas lighting. The 47 candles per c.ft. which Mr. Ionides claims should have been compared with the high-pressure form of lighting, which gives a higher duty than the system evolved by him. The variations that he mentioned of atmospheric pressure, of the pressure of air supply, of gas pressure, of air consumed, of gas consumed, and of quality of gas and of air, which are claimed to be neutralized by his invention, also offer ground for criticism. But by this no practical good would be served, as the degree of the variations in normal modern gas making and distribution practice are insufficient to cause any serious differences under present-day methods of gas use.

Shelved Difficulties

Those who have been following contemporary happenings must have been struck with the number of matters that are being piled upon the Executive Committee of the National Gas Council; but this accumulation is partly due to the shelving of difficulties until they could no longer be kept on one side. There is the question of the sliding-scale, maximum prices, and financial conditions generally. Nothing could be done. The gas industry, it was learned, must grin and bear the exceptional position in which it found itself. The matter has to be taken up now. There is the question of benzol. And there, again, nothing could be done. The Government Department chiefly interested did not see why there should be interference with Government prices, seeing that there were only some concerns in certain areas that were unfortunately placed. It is a bad look-out when a sum that pays under favourable conditions is regarded as a universally just one, even though an injustice is done by it to other concerns in different circumstances. At the meeting referred to, Mr. Samuel Glover said this matter was again coming up at a meeting of the National Gas Council. These are two questions that have been shelved, but must be attended to.

And New Work.

Then there is now a demand that the industry should be represented on the Coal and Coke Supplies Committees. There seems good reason for this. The difficulties of the Coal Controller are great; the difficulties of the country will be greater still if gas undertakings do not obtain their supplies. We hear of works that have been getting in pretty good stocks that have had with the shifting of the balance of their contracts under the redistribution scheme, this balance reduced by 25 p.ct.; we hear, too, of gas undertakings that have not yet been allocated collieries from which to draw their full supplies. There is much work in this respect that requires close attention—not only in the interests of the local communities, but in those of the country generally. There is the question of obtaining the inclusion of all gas undertakings in the schedule of Protected Occupations. There is also the difficulty of securing new gas-meters; and the National Gas Council are asked to exert influence to procure a higher priority category for them. It appears to be a fact that electricity undertakings are obtaining priority certificates not only for new customers, but for customers they are taking away from gas undertakings. There should at any rate be equality in this matter. At the moment the gas industry is bearing a considerable amount of burden; but Government Departments consistently overlook the fact that it requires fairplay and a certain amount of consideration. How on earth the gas industry got into the present position is a singular thing. The industry seems to be regarded by the Government Departments as something that should be "sweated" as much as possible, and denied even a shred of reward.

Gas-Driven Motor Vehicles.

We will not discuss here the draft specification for standardizing the filling arrangements for gas-driven motor vehicles that has been drawn up by Mr. W. M. Barrett, of the Manchester Corporation Gas Department. That uniformity, especially in fittings, is necessary is obvious; otherwise there will be difficulty in replenishing at different gas-works or other places. But Mr. Barrett's proposed specification [which is given on p. 65] goes beyond the question of fittings; and therefore we endorse the suggestion of Mr. Fredk. A. Price that, if there are any criticisms of the specification that can be made before it is finally adopted, he will be glad to see them. It is not only essential that uniformity should obtain in this matter, but as near as possible perfection; and the bringing of other brains to bear on Mr. Barrett's work may produce some further useful suggestions. If the specification cannot be improved, then the author has made a good shot straight away.

Action of Illuminating Gas on Plants.

The "Journal of the Chemical Society," Vol. CXII., p. 507 abstracts from the "Bulletin" of the German Botanical Society a paper on this subject by Herr C. Wehmer. He points out that illuminating gas exhibits no general poisonous character towards plants. Anaerobic fungi grow even in the undiluted gas, and cress seeds (*Lepidium sativum*) remain alive in it for weeks. It retards the growth of the embryo; but this proceeds uninterruptedly if the gas is diluted with about five times its volume of air. Gas is thus not an acute plant poison; but if it is passed for some time through soil, the latter becomes incapable of permitting seeds to germinate and grow in it. After such soil has been extracted with cold water, it behaves normally towards seeds; the injurious properties being transferred to the water. The principal constituents of coal gas to which its action on plants is due are sulphur compounds, benzene and its homologues, and (to a less extent) ethylene. Carbon monoxide is without effect on plants. [We are indebted to the "Journal of the Society of Chemical Industry" for this extract.]

Illuminating Gas from Coke-Ovens in Germany.—In the year 1903, lighting gas was produced in coke-ovens by two mining concerns only in the Dortmund district, besides which two more were running ordinary gas-works. The gas supplied by these four was about 46½ million c.ft. in that year. The next concern to take up making gas (in 1906) was the Deutscher Kaiser Association, now the greatest gas-producer among mining concerns, with an output of 1426¾ million c.ft. in 1914; and they were soon followed by others. In 1914, the output of lighting gas from coke-ovens in the Ruhr district amounted to nearly 4277¼ million c.ft., or nearly one hundred times the output of eleven years before. Many towns in the coal districts have shut-down their own gas-works, and are now taking coke-oven gas from the mines.

OBITUARY.

Mr. W. C. Rafarel, whose death at the age of 73 is announced, was long intimately associated with the progress of the gas industry in North Devon. His father, Mr. W. J. Rafarel, was for many years lessee of the Barnstaple Gas-Works, and Mr. W. C. Rafarel was for over 30 years, and up to the time of his death, a Director of the Company which now owns and carries on the works. He was also largely interested in the Ilfracombe Gas Company, of which, in 1894, he was appointed a Director, and in 1908 Chairman. It was largely due to his enlightened views that the Ilfracombe Company have in recent years developed and built new works at Hele, outside the town. Mr. Rafarel died at the house of his son at Kingswear. The funeral, at Barnstaple, last week was attended by Mr C. E. R. Chanter, the Chairman, Mr. F. W. Hunt, a Director, and Mr. F. L. Schofield, the Secretary, of the Barnstaple Gas Company; Messrs. M. Tattem and J. Vickery, Directors, J. Armstrong, Engineer and Manager, and A. Norman, Secretary, of the Ilfracombe Gas Company.

PERSONAL.

Mr. James Jamieson, of the Dalmarnock Gas-Works, Glasgow, has been appointed Assistant-Manager of the Dunfermline Corporation Gas-Works.

Lieut.-Col. W. R. Glover (whose award of the Distinguished Service Order was noticed in the "Journal" a fortnight ago) is a Director of the firm of Messrs. Thomas Glover & Co., Ltd.

Mr. J. Fred. Wicks, F.C.I.S., of the Richmond Gas Stove and Meter Company, Ltd., has recently been co-opted a member of the Council of the Society of Engineers (Incorporated).

Mr. Walter Hills has been elected Chairman of the Isle of Thanet Gas Company, in succession to the late Alderman Lazarus Hart. Mr. Hills has long occupied the position of County Court Registrar.

Mr. Will Thorne, whose name, as Secretary of the Gas-Workers' Union, has for many years been well known throughout the industry, is sixty years old to-day. He was employed at the Beckton Gas-Works at a very early age; and was elected Member of Parliament for West Ham as long ago as 1890.

For conspicuous bravery in the field, the Military Medal has been awarded to Mr. J. Barrett, of the North Staffordshire Regiment, and Mr. A. Corrigan, formerly of the Connaught Rangers. Prior to the war, both the men were employed at the Potteries Station of the British Gas Light Company.

After having been Manager of the Yeovil Corporation Gas-Works for over 45 years, Mr. Edward Howell retired on the 29th ult.; and he has been presented with an easy chair subscribed for by the employees. The Retort-House Foreman (Mr. Harry Ham) made the presentation, and in doing so spoke of the long period of over 35 years during which he had served under Mr. Howell, to whom they all wished many years of rest and health. Mr. Howell is succeeded by his Assistant, Mr. George Fenwick, a son of Mr. J. B. Fenwick, of Retford.

ELECTRICITY SUPPLY MEMORANDA.

We have previously called attention to an obvious requirement of the times. It is that our present controllers badly want a controller themselves who, through knowledge of what he is doing can regulate the decisions of the controllers and eliminate imprudence. The "Weekly Dispatch" calls public attention—not that the public need it, for householders are already perplexed—to the conflicting requirements of the different Government Departments. The householder is asked to lay in coal for the winter, which he cannot get. He is urged to use gas in preference to all else, on account of the bye-products obtained from the carbonization of coal; and on top of this comes the official suggestion that, in view of the probable shortage of coal, electricity should be used, which is the funniest means of economizing the consumption of coal that has ever been invented. Our weekly contemporary calls attention to these hostile recommendations. Those who have no electric appliances are just as badly off in complying with the official requirement as those who have no gas appliances, and cannot get them; and where there are only electric light circuits installed there are no means of responding to the call to use "more electricity and less coal." New power circuits and meters would be required, says the "Dispatch;" but this is impossible owing to the embargo placed upon the work by the Ministry of Munitions. "More electricity and less coal!" Heaven help the controller who tries to secure coal economy by this road. The estimated average consumption of coal in generating electricity is 4½ lbs. per unit, which at 14,500 B.Th.U. per lb. is equivalent to 65,250 B.Th.U.; and the resulting unit of electricity will only give the

Controlling the Controllers.

user, at an impossible 100 p.ct. efficiency, 3420 B.Th.U. Burned in his coal grate, the 4½ lbs. of coal would, with only 20 p.ct. heating efficiency, put into the householders' room 13,040 B.Th.U., as against the 3420 B.Th.U., assuming 100 p.ct. efficiency, of the electric-heater. At 34s. per ton, the 4½ lbs. of coal would cost the householder 0·819d.; while, according to war-time tariffs, he may have to pay 1d., 2d., 3d., and perhaps 4d. for his unit of electricity for heating, which will give him at most 3420 B.Th.U. The electric heating way is the way to the Bankruptcy Court or the workhouse; it is not the way to save coal; it denies to the Explosives Department the derivatives of the carbonization of coal of which they stand so much in need. Where is the man with the scientific knowledge to control controllers who may be highly practical in one particular line, but not in all, and so may be easily misled by interested parties.

The Agents and the Wholesale Trader.

Quite casually the other day, the writer came in contact with a wholesale trader (till then a stranger) in both gas and electrical apparatus. Conversation got switched-on to his business experiences; and, before long, we were laughing heartily at what he called the "fairy tales" of the agents for electric apparatus firms. He deals in lighting, cooking, heating, and water appliances—both gas and electric—and many other things. It matters not to him whether consumers adopt gas or electric apparatus. He is out to make a profit by sales. As to the rating of lamps, he has no photometrical knowledge; and if asked for an estimate for fitting-up certain premises, he takes the free and easy course of calculating requirements on the duty ascribed to lamps by the manufacturers themselves. Being a shrewd man, he gives no guarantee; making it quite clear that the efficiencies are those stated by the manufacturers. But he has been taking an interest in carrying-out rough-and-ready tests of gas-heating and cooking appliances. He knows the modern gas-fire and the modern electric-fire. He has tested them both in the same room by the aid of thermometers. It is a rough test; but it satisfied him, together with the reading of the meters, that for economy he could not recommend the electric-heater. But if a customer asks for an electric-heater, he does not try to sell a gas-fire. If asked for his advice, he relates his experience. Asked if he had heard of the fearful waste of meat by cooking in the gas-oven, and of the refusal of the electric-oven to waste more than (say) 10 p.ct., he laughed heartily. The tale, he said, had fallen from the lips of every bagman of the electric apparatus makers with the same ease that the alphabet falls from the lips of a child. He declared that he was utterly sick of hearing it. There was no confirmation in the experience of his own household, if the person using the competing ovens knew how to fairly handle them. The electrical travellers who call upon him do not like this sort of thing, nor do they his tests of the time taken by, and the cost of, boiling water on gas-stoves and electric-cookers. With him they have not by any means had matters all their own way. He is a practical man who is not going to be cajoled by their pet evaluations of their goods in comparison with those of other people; and he takes the lines of putting the goods to the test that are the only ones available to the ordinary householder; other than that he happens to have available both gas and electric meters for testing consumption, and he knows how to read them. In his home, the cooking, the heating of several rooms, and the hot water supply are all by gas. But he deals in electric heaters of all kinds.

Battle of the Arcs and Half-Watts.

When the war is over and there is relief from lighting restrictions, where electricity is favoured the battle will again begin between flame arc lamps and half-watt lamps; and everywhere high-pressure and low-pressure gas-lamps will be well in the contest with all electric-lamps. People we find are beginning to appreciate more than ever that the light of incandescent gas-lamps is preferable to that of electric light from the eyesight point of view; and with confidence gas people can claim for their light a lower intrinsic brilliancy than electric light, and a greater consistency with natural light. This, when we get back to normal conditions, is a point to be used in the competition, and to add to that of economy. The flame-arc people have had an ugly shock by the enormous preference shown for the half-watt lamp; and electrical undertakings are largely abandoning electric arcs. For what reason? Not because they have not had experience of flame arcs, and do not know their cost, the labour involved, the flickering, the uncertainty, and much else, but because they can get a steadier light with the half-watt, can better diffuse that light by reflectors, and all this with a smaller amount of attention. The flame arc people may make comparative statements as much as they please; all their statements will be examined in the light of experience. The makers of the "Metroflam" lamp are claiming that their non-interval magazine flame arc lamp is the most economical, effective, and trustworthy lighting system available. Of course, they mean among the electrical aspirants to favour. The 4000-candle power type is the one that is useful for the lighting of large open spaces; but who attests other than the makers that direct photometrical tests confirm the candle-power claim? On the asserted consumption of 500 watts, this means 8 candles per watt! Electrical readers are sometimes not above being a little sceptical of electrical claims. The makers of the lamps have published the following running costs of an 8-ampere "Metroflam" lamp giving 2000 c.p., and a couple of 1000 c.p. half-watt lamps running 1000 hours:

Eight-Ampere "Metroflam" Lamp.		"Half-Watt" Incandescent Lamps (2 × 1000 C.P.).	
Depreciation (including all repairs as well as renewals)	£1 5 0	Renewals (eight lamps, life 1000 hours at 25s.)	£10 0 0
Carbons	3 0 0	Depreciation of lantern and fittings	0 7 6
Current at 1d. per unit	5 19 8	Current at 1d. per unit	16 13 4
Labour, &c.	1 5 0	Labour, breakages, &c.	1 0 0
Total	£11 9 8	Total	£28 0 10

It will be noticed that while the whole of the new eight half-watt lamps are charged for, no capital outlay is mentioned for the "Metroflam" lamp. Current nowadays is not often charged at 1d. per unit for lighting; we have seen much higher figures mentioned. The other figures would also bear investigation by the aid of experience; and they might come out of the ordeal somewhat enlarged on one side of the comparison. It would also be useful to have an independent checking of the declared candle power.

Carbon Prices and Half-Watt Lamps.

There is in the comparison the item of carbons. No mention is made of the cost taken and the number of pairs of these required during a year's lighting. But we are interested in a report recently made to the Hackney Borough Council, which tells a tale of present carbon prices, and of the drift of preference as between arc lamps and half-watt ones. The Council had a contract with the General Electric Company for the supply of lamp carbons of different sizes at from 60s. to 70s. per 1000 pairs. The contract was entered into in 1914. The prices ruling to-day, however, are no less than £12 4s. 6d. and £10 respectively; and the Company submitted to the Council that, if they have to complete the contract at the original price, they would suffer serious loss. The Electric Supply Committee of the Borough Council were sympathetic; and they made the Company an offer which the latter were pleased to accept. The offer was that the Company should be relieved of the completion of the contract, provided that they agreed to supply the Council with 600 half-watt lamps within one month of the removal of the public lighting restrictions. The lamps will be supplied at the list price in force on the date on which delivery is made, subject to a discount of 28 per cent. The arc lamp makers will probably write down the Hackney Electricity Committee as a set of fools. Nevertheless, this is an evidence of the direction in which the wind is blowing, and will continue to blow after the war.

Water Heating.

The housing problem after the war is we are told, to be a large one. Our house equipments then are going to be very different from what they have been in the past. The past has not been good enough; and so the new El Dorado. Of course, since the war started, building has practically ceased. It is as much as one can do now to get a room papered and painted; let alone having a house built. Therefore, it is expected that after the war, when people return completely to a sane and free mode of living, there will be a large request for more houses, and houses fitted with modern conveniences. But for a long time yet, building materials will be dear owing to the law of supply and demand. The gentleman who supplies the "Cooking and Heating Notes" to the "Electrical Times" mentions this; and, in the same connection, he refers to electric water heating, from which apparently, at the back of his mind, he has some feeling that there is propriety in having harmony in expense all through. But accompanying this feeling is another, that the manufacturers have not yet designed electric water-heating apparatus which can be regarded as meeting public and private requirements, and which can be operated at a reasonable cost; for he says it is imperative that an effort should be made by manufacturers to do what is needed. What the makers cannot possibly do is to make a unit of electricity of greater calorific value than 3420 B.Th.U. He also fully realizes that "the great objection to electric heating in this country is its cost;" and yet another objection (this is a point he does not notice) is its dilatory manner of accomplishing the work. To advise a person to have an electric water-heating arrangement for bath and other purposes which require substantial supplies of water is one of the biggest jokes that has ever been perpetrated in these days when people are urged to take a commonsense view of domestic economy and labour-saving. To have to wait twenty-four hours for sufficient water to be heated-up for a bath, or to fit-up an expensive apparatus that will do the work at a rate which will not affect one's patience so grievously, is as good as asking householders to retrace their steps (say) a few centuries in respect of this particular requirement of our daily life. Whether the writer of "Cooking and Heating Notes" can conscientiously recommend electric water-heating for all and sundry purposes in the house that is coming after the war, we do not know; but his plea that manufacturers should do something that it is a physical impossibility for them to do, suggests that he is allowing a struggle for supremacy to proceed between knowledge as to the physical impossibility and hope that even now some way may be found out of the impasse.

A Suggested Combination.

In this matter of water-heating, the electricians try to grasp every passing straw. The writer in our contemporary learns that the Southern Californian Edison Company, of Los Angeles, have water-heaters by which at any rate (so it is said) the difficulty of cost can be overcome. We fail to see that, although different electric water-heating appliances may have different efficiencies, they can, apart from the small differences in this respect, alter costs. They cannot alter the cost at which current can be supplied; they cannot alter the fact that, to heat water from one temperature to another, a certain number of B.Th.U. have to be applied; they cannot alter the fact that with the most profuse and careful lagging, the longer the water undergoing heating has to stand, the greater the loss of heat by radiation, by convection, and by conduction. The Los Angeles Company have two types of water-heaters—the circulating type of 3 to 4 KW. rating, and the submerged tank type, with units taking from 800 watts to 1500 watts. The second type appears to our electrical friend to be the more interesting, as it may be used in conjunction with an electric range. "It gives hot water at all hours, and at any degree desired." We are not told what is meant by this. It may with the current always on give hot water at all hours, but in limited quantities. But suppose half-a-dozen people in a house require a hot bath the same day, what will happen? These questions are perhaps a bit awkward; but they ought to receive reply from a person who asserts that a combination of one of these heaters with an electric-range offers a wide field for exploitation in this country. If in the new modern equipped houses that are going to issue from the consideration of the post-war housing problem, a combination of an electric-range and water-heater is introduced, the tenants will be driven mad. This must be avoided; and we suggest that, as gas-cookers and gas water-heaters are liberally used throughout the country on account of money, labour, and time economies, gas still offers the best solution of the problem.

GAS-DRIVEN MOTOR VEHICLES.

Draft Specification for Standardizing Filling Arrangements.

THE following draft specification has been prepared by Mr. W. M. Barrett, the Manager of the Manchester Corporation Gas Department Private Lighting Department, with the object of securing standardization in the filling arrangements for gas-driven motor vehicles in the district. In forwarding to us a copy of the specification, Mr. Fredk. A. Price, the Superintendent of the Gas Department, remarks that it is essential for uniformity to obtain in this matter, especially with gas undertakings within a radius of 60 miles of Manchester. He adds that he will welcome any criticisms of the suggestions made before their final adoption.

SUGGESTED STANDARDIZATION OF FILLING ARRANGEMENTS FOR CONTAINERS FOR GAS-DRIVEN MOTOR VEHICLES.

Meters.—Automatic type, 100-light size, fitted with special quick opening and instantaneous closing valve, the valve having a gas-way equal in area to a 2-in. pipe, to be operated by a metal token (not coin size), each token representing 100 c.ft. of gas.

Fittings.—The outlet of meters to be fitted with flanges for 2-in. iron pipe, into which a 2-in. iron full-way plug cock is fitted. Each installation to be supplied with a 20 ft. length of 2-in. rubber packed flexible metallic tubing, fitted each end with a 2-in. gas-thread female flat-face union.

Position of Meters.—Meters to be fixed at garages or similar establishments on all main roads, and to be fixed free of charge to the tenant. The tenant to be allowed a rebate of 10 p.ct. on the face value of all tokens collected from the meter fixed on his premises, as a remuneration for rent and any trouble he may be caused in connecting-up to vehicles, although it must be made clear that the responsibility for connecting-up rests entirely with the driver of the vehicle.

Price of Gas.—4d. (four pence) per 100 c.ft.

Tokens.—Tokens (each being value for 100 c.ft.) may be purchased at the gas offices or other convenient places at 4d. (four pence) each for cash, and must be stamped with the name and address of the gas undertaking issuing them.

Interchange of Tokens.—Arrangements to be made whereby foreign tokens collected from a meter may be returned to the issuing office, who should give either a credit note or cash for the face value of such tokens, or tokens of a similar value, to the collecting company.

Working Instructions.—An enamelled plate to be fixed in a prominent position close to each meter, lettered somewhat as follows:

INSTRUCTIONS.

1.—Connect up union end of flexible tube to inlet-pipe of gas-container, taking care that all joints are gas-tight.
2.—If the vehicle is fitted with a main cock in the inlet-pipe to the gas-container, see that it is open. See that the engine control cock is closed. See that main cock fitted to outlet of meter is closed.
3.—Insert one or more tokens, and turn handle in the direction of the arrow.
4.—When gas-container is filled;
Close main cock on meter.
Close main cock on inlet of gas-container.
Disconnect flexible tubing.

Advertising.—The situation of these meters, and the hours the establishment is open and the meter available for a supply of gas, to be stated by the gas undertakings joining in this scheme.

The whole of the information thus obtained to be issued in a booklet, and distributed free of charge to owners of motor vehicles on application.

Enamelled plates to be provided and fixed in a prominent position on the premises in which meters have been fixed, indicating that motor vehicles may be charged up with coal gas.

Standard Pipe Fittings for Motor Vehicles.—If 2-in. gas-thread is adopted as the standard fitting on the flexible tube, the gas undertakings joining in this scheme should advise all vehicle owners (and insist if necessary) to fit up their vehicles with the inlet-pipe to the gas-container fitted with a similar size thread—namely, 2-in. gas. A drawing of a vehicle fitted-up in the way advised should be made, and a line-block made from it. This block should be reproduced in the booklet referred to, together with a copy of the working instructions, and advice as to how the best results from coal gas may be obtained.

THE WHOLESALE COAL PRICES ORDER, 1917.

Factors' Charges and Ash in Coal.

WE are informed by the National Gas Council of Great Britain and Ireland that last Tuesday afternoon a deputation waited upon the Controller of Coal Mines in reference to the Wholesale Coal Prices Order, 1917, issued by the Board of Trade early in September. The deputation consisted of the following:

Mr. A. E. BROADBERRY.
Mr. G. M. GILL.
Mr. SAMUEL GLOVER.
Mr. D. H. HELPS.
Captain R. S. HILTON.
Mr. D. MILNE WATSON.
Mr. GEORGE AIRTH (Irish Association of Gas Managers).
Mr. W. G. S. CRANMER and Mr. GEO. STEVENSON (Midland Association of Gas Engineers and Managers).
Mr. G. S. FRITH (Manchester Institution of Gas Engineers).
Mr. W. HARDIE (North of England Gas Managers' Association).
Mr. J. E. KENSHOLE (Wales and Monmouthshire District Institution of Gas Engineers and Managers).
Mr. F. M. PATERNOSTER (Eastern Counties Association).
Mr. H. E. RILEY (Cornish Association of Gas Managers).
Mr. ALEX. WILSON (North British Association of Gas Managers

Mr. Milne Watson introduced the deputation, and dealt with the various points affecting gas undertakings. His remarks were supported by Mr. Airth, Mr. Glover, Captain Hilton, Mr. Kenshole, Mr. Riley, and Mr. Wilson.

The Controller of Coal Mines was sympathetic, and explained that the rates of commission mentioned in the Order are *maximum* ones; and he gave the assurance that any case brought before his notice, of a factor or merchant charging an excessive rate, would receive his prompt attention.

The Controller informed the deputation that he fully recognized how serious was the question of ash in coal; and he stated that specific complaints lodged with him would be dealt with.

On the subject of contracts, the Controller pointed out that the reason for these having been cancelled (deliveries being continued as usual) was to enable a buyer, who considered a price too high, to have the question settled by the Controller once and for all.

BYE-PRODUCT COKING.*

Reviewed by JOHN W. LEE, F.C.S.

THIS the latest volume of an excellent series issued from the office of the "Gas World" is brought under review with peculiar interest. The earlier volumes have been more directly concerned with the carbonization of coal and allied subjects from the standpoint of the gas engineer. They have been welcomed by the coke-oven manager, and find a place in the library of every up-to-date coking plant. The Publishers, however, have been wise to recognize the need of a volume which should place before gas engineers and all interested in carbonization the methods adopted, and the apparatus used, in coking practice. The author unfortunately died, leaving his task unfinished. By his death, there was lost to the industry a virile and original thinker and a ready writer. The book shows evidences of the circumstances under which it was written—the serious handicap of ill-health. It is, however, a monument to the courage and determination of the author.

It is difficult in these circumstances to write a review. One is conscious that, had the author lived, many of the blemishes would have been removed in correcting the proofs, and others in later editions when pointed out in friendly criticism. As is stated in the preface, the subject is one of national importance. The bye-product coking plants in existence on the outbreak of the war were a national asset and the country's salvation in its need for high explosives and other munitions of war. As is further pointed out, there is a "distinct lack of a suitable text-book upon the subject." In so far as he intended to "put into the hands of those interested an up-to-date and accurate account of the industry as

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it stands at present," the author has succeeded in large measure. While not exactly "popular," it is written in a style which is "intelligible to the ordinary reader." But in so far as the author intended to write a student's text-book, he has certainly in some respects failed.

As in the earlier volumes in the same series, the printing is excellent, and the illustrations reproduced in fine style. The arrangement of text and illustration is not good. Only by constant turning and returning can these be followed. On p. 38, a section of the Coppée oven is shown in the text referring to the Otto oven; on p. 41, a Huessener is thrust into the Collin text. To a student drawings present many difficulties. In any text-book these should be printed in close proximity to the descriptive matter, and there should be perfect agreement between the lettering on the drawing and in the text. None of the lettering is too clear, and only a very diligent student would attempt to trace it. In some cases, a trained coke-oven manager would fail.

Space does not permit of more than a few examples of this vital point. Three sectional drawings are given of the Collin oven—figs. 11b, 11, and 11a, in this order; but in the description of the working of the oven no attempt is made to indicate on which drawing the lettering is to be found. In describing the "B.C.O." waste-heat oven, on p. 57, four air ducts—A, B, C, D—are mentioned. The drawing illustrating these, which is not mentioned, is found nine pages later, after the Semet-Solway oven has been completely described and the description of the "B.M." oven commenced. Fig. 17 on p. 53 should be fig. 16. K in fig. 21 becomes H in fig. 22. In many cases drawings are marked "cross sections," and the type of oven not stated. The student needs training to speak and think of methods, plant, and materials in exact terms. A "waste-heat" flue in the drawing should not become a "collecting" flue in the text. Why "regenerative chambers" and "regenerative tunnels"? "Ram" is surely better than "pushing machine." A "waste heat" flue on a regenerative oven is a misnomer. "Heating gas," "combustion air," and other such loose terms should not be found in a text-book.

The chapter on "Coal and Coke Handling Machinery" is as full as could be expected in a book of this size. The author is more at home in dealing with the recovery and working-up of the bye-products; and in a necessarily limited space he gives a good outline of the methods adopted in the various systems.

The chapter on "Chemical Tests" is compressed into only ten pages, and could not, therefore, be more than scrappy. The coke-oven laboratory pupil will find it a good syllabus, but lacking in important detail. Necessary factors are missing, and errors have crept in—200 c.c. of ammoniacal liquor is an excessive quantity to take when estimating the total ammonia content, and 25 c.c. of N acid would not be sufficient to distil into. In estimating free ammonia, why use N_2 acid, and 100 c.c. of it, when distilling 20 c.c. of liquor?

The method given for estimating free lime (CaO) on p. 156 is useless. It ignores iron and alumina, carbonate, and sulphate of calcium. It is a very poor lime that is "not more than 75 p.c. pure."

The book is well worth possessing by the general reader, gas engineer, and coke-oven manager and student. It goes some considerable way to supply "the lack of a suitable text-book," and its plan will be of great assistance to the author who next sets out to supply this lack. How quickly a book dealing with any phase of the chemical industry may become out of date, especially in war time, is illustrated by the statement, written less than a year ago (to take the date of the preface), "that strong liquid ammonia is rarely, if ever, made on coke-oven plants, and there fore not considered here." The statement was not quite accurate then; but it is far from correct to-day.

GAS FROM WOOD AND PEAT AT BERNE.

Our French contemporary, the "Journal des Usines à Gaz," publishes in its issue of Sept. 20 a report, by two of its correspondents who have been on a mission to Switzerland, on the results recently obtained at the Berne Gas-Works in the use of wood and peat as partial substitutes for gas coal.

In ordinary times the daily make at Berne is 49,000 cb.m. (1,700,000 c.ft.) in winter, and 29,000 cb.m. (1,000,000 c.ft.) in summer. The carbonizing plant consists of Dessau vertical retorts and a bench of Coze inclined furnaces. At the present time, five Dessau benches are run for twelve hours, followed by one hour's steam injection; two Coze furnaces are working with coal (distilling in six hours); while in a third Coze furnace wood is distilled for three hours. The yield of gas from the last-named is 2370 cb.m. (83,700 c.ft.) equal to 10 to 12 p.ct. of the total make.

The lower retorts of the Coze bench are charged with small sticks of fir; the upper retorts with large pieces, roughly stripped of bark. The average charge for a retort is 170 kilos (270 lbs.) as against 350 kilos (770 lbs.) for coal. On six days of the week the bench is run on wood; on Sundays, with coal, for the purpose of restoring the carbon deposit. A recent figure for the production of gas from the wood is 23 cb.m. per 100 kilos (410 c.ft. per cwt.) From dried wood the yield of coke has been about 20 p.ct.; from green wood, about 9 p.ct. The coke from the larger pieces of wood, as also the charcoal dust from the smaller fragments, is used in admixture with ordinary gas coke to heat the furnaces, the temperature of which on a Monday is 1300°, falling to 900° C. on Saturday, after six days' carbonization of wood.

The gas is taken into a hydraulic main—there is one to each bench—by one or other of two chief mains which traverse the furnaces, one of these serving for coal gas and the other for that from wood. As means of avoiding as far as possible the condensation of acid liquors in the hydraulic main, the temperature is kept near 100° C., and attention is given to the water by inspection every hour or every three hours, when, also, observation is made of the state of the iron plates.

At Berne the gas is passed with the least delay to a condenser formed by water flowing through a coil in the opposite direction to that of the gas, and needing for the daily make, 2400 cb.m. (85,000 c.ft.) of gas, about 300 cb.m. (66,000 gallons) of water. In this condenser the greater part of the aqueous liquor and tar is collected, and the gas then passes through a meter, both inlet and outlet of which is fitted with a trap for condensed vapours.

In regard to peat, the Berne works have so far distilled only 36 cb.m. in a run of twelve hours. The peat is obtained from Moosseedorf, in the neighbourhood, and has been used in its natural state—that is, with 33 p.ct. of moisture. The condensed liquors proved to be alkaline, and served in part to neutralize the acidity of those from wood. They became of violet colour, while the tar was brownish and had an odour of burnt wool. The coke from peat, after once becoming ignited, is difficult to extinguish, but burns slowly.

The following measurements have been made of the physical and chemical properties of the gas from wood and from peat.

		Wood.		Peat.
Calorific power gross—calories		3420	..	3500
,, ,, net—calories		3125	..	3185
Density		0·721	..	0·712
Chemical Composition. Parts per Hundred.	Carbon dioxide	24	..	25·8
	Heavy hydrocarbons	2·7	..	3·3
	Oxygen	0·0	..	0·0
	Carbon monoxide	21·9	..	15·7
	Hydrogen	38·2	..	41·9
	Methane	8·9	..	10·5
	Nitrogen	4·3	..	2 8

While the results, in regard to peat, have been communicated, the material has been in use for too short a time for definite conclusions to be drawn.

The Consumer as Financial Partner.

The fact that good public relations are essential in the operation of what are known as utility undertakings requiring permission to use the streets, led Mr. W. H. Hodge to deal at length, in a paper read at the Harvard University, with the subject of the "Customer as a Financial Partner in a Public Utility." The concerns referred to in this sense were gas, electric, telephone, and traction organizations. It has, he said, been the deliberate policy that such undertakings should be conducted by privately owned companies; and 95 p.ct. of electric light and power work, and very nearly all the gas and other businesses, is so conducted. Public utilities in growing communities demand an annual supply of new capital for extensions, additions, and improvements, over and above the replacement reserves derived from earnings; and a good sized list of local shareholders has a definitely favourable bearing on the cost of money for financing. Everything helping to cheapen the cost of capital to utility undertakings is a most effective step towards cheapening the selling cost of the product, since capital charges absorb approximately one-half of the gross earnings of such companies. If, therefore, customer ownership succeeds in making financing cheaper and easier for the companies, it will assuredly help them in maintaining minimum prices to the consumer. Assuming that customer-ownership brings the people and the corporations into closer harmony than now, and forms a veritable bulwark against unfair political treatment, there can be no doubt that the securities of the utility companies will press closely on government and municipal bonds as premier investments. When a company is owned solely by non-residents, the agitator usually makes strong capital of the fact. The partnership plan, involving the actual investment of money by the individual, enlists the positive self-interest of every shareholder. The subject of employee-ownership, though somewhat allied to that of customer-ownership, is a distinct and important undertaking. Mr. Hodge gave particulars of the scheme of the Northern States Power Company to sell stock directly to their customers; one of the features being a gradual payment plan. The scheme represents a permanent policy; and primary effort is put forth so as to secure the broadest possible distribution of stock among the greatest possible number of people. The Company own electric, gas, and other services, and serve 139 communities, with a population of 875,000. The benefits to the utility company and to the public which will assuredly follow a wide distribution of a company's securities among its patrons, he declares, warrant the effort and initial expense.

Coal Gas Not Regarded as a "Petrol Substitute."—The Automobile Association having drawn the attention of the Ministry of Munitions to the uncertainty existing as to whether the use of coal gas for driving motors was likely to be restricted by licences or confined to cars employed for special purposes, the Ministry have replied that they do not regard coal gas as coming within the category of a petrol substitute. On the question of the unrestricted use of gas, the Ministry state that they are consulting the Home Office.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

HALF-YEARLY MEETING AT NEWCASTLE-ON-TYNE.

THE Half-Yearly Meeting of the Association was held last Saturday afternoon, at the offices of the Newcastle and Gateshead Gas Company, Grainger Street West, Newcastle. Mr. RICHARD NELSON, of Hull, the New President, was in the chair; and there was a large attendance.

DIED FOR HIS COUNTRY.

The PRESIDENT said that since their last meeting they had had to regret the loss through death of one of their associate members—Lieutenant Armstrong, of Wallsend, who had been killed while on duty for his country. A letter of condolence had already been sent to the parents of the deceased officer; but, as a mark of sympathy with them, the President asked the members to rise in their places.

The token of sympathy was duly shown.

LETTERS OF APOLOGY.

Letters of apology for absence were received from Mr. W. Doig Gibb, Mr. W. B. Leech, Mr. C. Dru Drury, Mr. T. H. Duxbury (who had not missed a meeting for seventeen years), Mr. W. Whatmough, Mr. James E. Kenshole, Mr. John Lang, Mr. H. C. Head, Mr. J. H. Brearley, and others.

ASSOCIATE MEMBERS.

The following were elected associate members of the Association: Mr. Thomas Settle, of Roundhay, Leeds; Mr. John E. Parker, of Newcastle; and Mr. Charles H. Mitchell, of Leeds.

FIFTY YEARS' SERVICE.

The PRESIDENT alluded to the fact that Mr. Thomas Waddom, the Secretary of the Newcastle and Gateshead Gas Company, was about to complete fifty years' service with the Company; and he moved the following resolution:

> That the Hon. Secretary be requested to convey to Mr. Thomas Waddom the hearty congratulations of the Association on his approaching Jubilee in the service of the Newcastle-on-Tyne and Gateshead Gas Company, and hereby expresses the hope that he may be spared for many years to guide the destinies of the undertaking and continue the very valuable services he has rendered to the Association and the industry generally.

Mr. W. HARDIE (Tynemouth) seconded the proposal, and paid a high tribute to the work which Mr. Waddom had done for the Association, and also for the Special Purposes Section. His labours had been of so valuable a nature for the industry generally that he (Mr. Hardie) thought it only right that the resolution which the members had heard read should be carried with hearty unanimity.

The resolution was cordially agreed to.

The PRESIDENT then delivered his

INAUGURAL ADDRESS.

Gentlemen,—Allow me to again thank you for the honour you have conferred upon me in electing me President of this Association. With your kind indulgence I hope to be able, at the termination of office, to hand down the high reputation of our line of Past-Presidents, if not with added credit, then at least with undiminished lustre.

In searching for subject-matter for an address of this nature, one naturally wishes to adopt as wide a view as possible—say, a review of the past and of the present, and some indication of the future, the pointing out of defects in our structure, and the means of repairing them. Abler pens than mine have already dealt with such important matters; and I will ask you to bear with me, if my choice seems somewhat restricted, and if I deal with my more immediate surroundings, and confine myself almost exclusively to my own work's practice.

The Company whom I have the honour to serve—the East Hull Gas Company—was founded in the year 1846 as the Sutton, Southcoates, and Drypool Gas Company, to supply the districts of Southcoates and Drypool within the borough boundary of the City and County of Kingston-upon-Hull, and the village of Sutton outside the city boundary. These districts are now practically joined up; building extensions during the past decade or two having been very extensive. The Company's scheduled area comprises about 7500 acres, with a population in round numbers of about 90,000. The district supplied lies all to the east of the River Hull, and the possibilities are very good, including as it does the latest extension to the Hull Docks—viz., the King George Dock of the North Eastern and the Hull and Barnsley Railway Companies. When normal times again come round, we quite anticipate that East Hull will share in the general prosperity that we, I think rightly, expect. The works are situated in the midst of a commercial and industrial centre, and the area of the present site is about 5½ acres.

The following table, covering a period of the past ten years, shows the steady growth of the Company's business in pre-war times, also the adverse effect of the war.

The proportion of coin meters to the total number of meters (as shown in the table) is due to the fact that the population of the area supplied consists largely of the artisan class; and this class of business is even yet far from reaching saturation point. The same may be said of the "Cookers on Hire" portion of the business, although activities in both branches are temporarily suspended.

WORKS' SITE AS AFFECTING STRUCTURES ERECTED.

The ground strata of the site upon which the works are built is not of a very satisfactory nature from an engineering standpoint. We have a bed of running silt—varying in depth from 6 ft. to 12 ft. and from 6 ft. to 9 ft. from the surface—throughout the whole of the works and the surrounding area. One instance of the trouble caused by such strata may be of interest. About seven years ago an extension of the purifiers was decided upon, and the only available site was partly over a disused brick and puddle gasholder tank, 82 ft. diameter. A start was made by roofing over the tank with a reinforced concrete cover on the Hennebique system—the cover consisting of a flat slab supported by main and secondary girders carried on reinforced concrete columns. The original dumpling was excavated, and reinforced concrete footings laid down for the columns. On completion, the purifiers were put in hand, being of the usual cast-iron construction, with dry-seal covers. Two boxes were erected, separated only by a single division; and one corner of the construction is resting on the concrete cover of the tank previously mentioned, the remainder of the boxes being on solid earth. About one-third of the area of the bottom of the purifiers is resting immediately on the tank cover.

After the purifiers had been at work some time, it was decided to prepare the tank for the storage of tar and liquor; and as it was far from watertight, it was arranged to concrete the whole of the bottom and to render the walls (after chipping) with 1 inch thickness of cement and sand, laid on in two separate layers. Water was freely "weeping" through the walls in various places. [Mention ought to be made, that one side of the site is bounded by an agricultural drain at a depth considerably below the yard level.] Before any success was attained with the cement rendering, drip-pipes had to be used in the walls. These were of 1½ in. diameter wrought-iron tubing, and were driven well into the wall and allowed to project some 2 or 3 inches beyond the inner face. As the rendering was brought nearer to these drip-pipes (and some twenty or thirty were used in all), the water found free vent through the pipes, and hence into the tank, where it was led to a sump and pumped out. The two coats of cement rendering were allowed to thoroughly harden; and then the drip-pipes were carefully sealed-up with cement, commencing with the drips in the lower portion of the walls, and gradually proceeding upwards.

On completion, it was found a very satisfactory job had been made of the tank from a water-tight standpoint; and it was now thought that our trouble on this particular portion of the works had ceased. But this was not so, and as we had not yet pumped any tar or liquor into the tank, subsequent events proved this to be very fortunate. A few months after the completion of the work, we noticed that the vertical flanges of the outside purifier

Year.	Gas Made.	Increase.	Number of Consumers.			Gas Sold.			Price of Gas per 1000 Cubic Feet.	Miles of Mains	Number of Consumers per Mile of Main.	Cookers on Hire.
						Thousands of Cubic Feet.						
		Per Cent.	Ordinary.	Prepayment.	Total.	Ordinary Meters	Prepayment Meters.	Public Lighting.				
1907	236,623,500	14·78	2,666	4,343	7,009	148,079	46,139	19,315	..	46	152	1,067
1908	256,188,400	8·27	2,790	5,020	7,810	154,641	55,902	18,835	2/3	51	153	1,180
1909	271,944,100	6·15	2,892	5,868	8,760	158,062	65,557	18,875	2/3	55	158	1,374
1910	285,285,500	4 90	3,046	6,600	9,646	161,649	74,068	20,198	2/3	59	163	1,476
1911	303,634,000	6·43	3,151	7,257	10,408	170,288	83,151	22,744	2/3	60	170	1,499
1912	327,036,000	7·71	3,217	7,861	11,078	177,360	101,715	22,315	2/3	61	180	1,000
1913	339,169,600	3·58	3,297	8,410	11,707	177,185	108,912	22,448	2/3—2/0	62	188	1,732
1914	354,982,400	4·62	3,366	8,870	12,236	170,874	124,099	21,006	2/0	63	194	1,995
		Decrease										
1915	340,062,700	4·23	3,383	9,284	12,667	168,468	130,909	12,013	2/0—2/-	63	201	2,109
1916	327,585,800	3 67	3,333	9,348	12,681	162,488	126,190	8,700	2/3—2/0	63	200	2,103

plates were cracking about the middle of the depth of the plates; the cracks extending from the bolt-holes to the outer edges of the flanges. Nearly all the joints on two sides of the boxes cracked in this way; and various theories were, of course, advanced and discussed as to the cause and its likely prevention. However this was not the worst, as a short time after, the top plates of the boxes commenced cracking, until we had four cracks in the top plates of one box, varying from about 9 in. to 18 in. in length. Discussing this one day on the site, there was pointed out an apparent rise in the flat concrete cover of the tank. This was at once investigated; and it resulted in a very careful examination of the bottom of the tank. We found that the bottom and the footings of the columns were actually rising, of course carrying the columns and the cover with them. Now, as the purifiers were resting, as to one corner only, on the tank cover, it follows that this corner was being displaced upwards—the remainder of the boxes being on solid earth. Hence the cracking of the cast-iron plates. The cause of this trouble was therefore solved.

As it was a unique experience (to the writer, at any rate), the builder who carried out the tank alterations was called in. He is a contractor whose experience of the Hull subsoil is, I believe, second to none, as he has built a large number of our heaviest buildings in the city. But he confessed that this was quite a new experience to him also. We then set to work to carefully ballast the portion of the tank bottom immediately under and carrying the purifiers. This was done with the heavy coping stones that had been taken from the top of the tank walls. These were placed over the column footings, until we were satisfied that we had overcome any further tendency for the bottom to rise. It was considered safer to use such ballast, rather than rely altogether upon the weight of any tar or liquor that might have been put into the tank, as by doing so it was felt that no recurring trouble would arise if at some future time the liquor tank is empty, or nearly so. No further trouble has been experienced. Such is a brief account of trying to make "bottle-tight" an underground tank built in a water-logged area.

WORKING OF THE VERTICALS AT EAST HULL.

I had the privilege of reading before the Association at the May meeting, 1912, a paper descriptive of the intermittent vertical retort installation erected at the East Hull Gas-Works during the year 1911. The installation was brought into actual work during October, 1911. Then at the 1913 Spring meeting some further working results obtained with these verticals were laid before the Association. It is not intended to traverse the information given in the foregoing communications; but as we have now had six years' experience in the working of the retorts and have re-set all contained in this house, I propose to give a few further details, and also the costs of re-setting these retorts—a subject round which there has been a considerable amount of speculation and anxiety.

We soon found that the original tar off-takes from the hydraulic mains were not suiting the conditions under which we had to work. We, therefore, set about designing special tar off-takes; and during the summer of 1913 all the five beds were fitted with the new arrangements. This proved a somewhat difficult task, as only one bed could be let down at a time; and the work entailed the fixing of new tar-mains throughout, without disturbing the old arrangements in use on the remaining beds. The work was carried out by our own staff with every credit; and I am indebted to our Works Superintendent for the manner in which the job was carried through without a single hitch of any kind.

The new tar off-takes consist of a dwarf tar tower to each length of hydraulic main. This tower is carried by cantilevers from the bench ironwork. The bottom of the tar-tower is connected to a 6-in. diameter tar-main through the medium of a 3-in. gland-cock, which is controlled by a lever from the hydraulic main gantry. A 6-in. tar off-take pipe reaches from the bottom of the hydraulic main to the side of the tar-tower near the bottom. The top of the tower is above the level of the top of the hydraulic main; and the liquor levels in the latter are controlled by two 1¼-in. diameter wrought-iron pipes fixed in the tar-tower, and communicating independently with the tar-main. The lower level overflow pipe is at such a position that when in action all the dip-pipes are unsealed; and this pipe is controlled by a gland cock operated from the hydraulic main gantry. The higher level overflow is provided with an adjustment whereby the seals on the dip-pipes can be altered at will. This pipe is not fitted with a cock, but is connected direct to the tar-main. The dip-pipes can, therefore, be sealed or unsealed, and the amount of the seal varied as desired; and it is the practice to work with the dip-pipes unsealed excepting while actually charging and discharging the retorts. The bottom of the tar-tower is connected to the tar-main by a valve, by opening which a straight flushing through action is obtained from the hydraulic mains to the tar-mains; and the falls being very generous, any obstruction is quickly cleared. This flushing action is carried out regularly, so that the whole system of hydraulic mains, tar offtakes, and tar-mains is kept in perfect working condition. The foregoing may sound somewhat elaborate, being thus described; but the whole arrangement is perfectly simple, and has given every satisfaction since its introduction. It has also been adopted by the builders of these verticals on other installations, with, I believe, similar success.

There is a marked difference in the composition of the deposits in the pitch-pans between working under the old and the new conditions, as shown by the following figures.

Pitch Pan Deposits.

	Old Tar Offtakes.	New Tar Offtakes.
Volatile matter	38·4 p.ct.	73·25 p.ct.
Total residue	61·6 p.ct.	26·75 p.ct.

The easier working conditions, no back-pressure in the retorts (due to the simple method of unsealing the dip-pipes), and no backing-up of tar and liquor in the hydraulic mains, resulted in increased efficiency all round. The average make of gas per ton of coal was also increased.

The previously published results (from May, 1912, to May, 1913) have not only been upheld, but surpassed, which is proved by the following figures extracted from our working statements for the year to Dec. 31, 1916, and for the six months to June 30, 1917.

	Year ended Dec. 31, 1916.	Six Months ended June 30, 1917.
Coal gas made	297,741,800 c.ft.	144,393,200 c.ft.
Carburetted water gas made	29,844,000 c.ft.	28,167,500 c.ft.
Coal carbonized	19,987 tons	9,211 tons
Gas oil used	43,575 gallons	37,053 gallons
Gas made per ton of coal carbonized (coal gas only)	14,897 c.ft.	15,676 c.ft.
Oil used per 1000 c.ft. of carburetted water gas made	1·46 gallons	1·31 gallons
Illuminating power of "mixed" gas, average of daily testings	14·62 candles	14·14 candles
Calorific value of "mixed" gas, average of daily testings	526 B.Th.U.	531 B.Th.U.

Horizontal retorts, hand worked, were in use for the first ten weeks of 1916; but no allowance has been made on this account in the item of "make per ton" as given for the year. The coal used throughout the whole of the period covered by the foregoing results was South Yorkshire Silkstone.

Some few months ago one of our technical papers in writing of carbonizing results in reference to "test" figures said: "It would be of immense service to the gas industry if some of the gentlemen who are using vertical retorts could show that, over a period, they have approached the efficient carbonization typified by the tests we referred to." Again, the same paper wrote: "Generally speaking vertical retorts are a complete failure. There is no elasticity about them. When a bed is lighted-up, it must be kept up. Letting them down is fatal. The beds go to pieces. The cost of maintenance is prohibitive," &c., &c. I hope the figures already given will satisfy the first question; and facts a little later on, will, I think, enable the writer of the articles to at least modify his statements.

Speaking of test results and figures and as to analyses given, British thermal units per ton is a test that cannot be refuted; and if we are to conserve our coal supplies as we have lately been pressed to do, then this matter of British thermal units per ton of coal is of primary importance to our industry, and is one to which we shall have to pay considerable attention, as a reasonably cheap gas supply depends upon them.

Details of the life of the East Hull vertical settings, and of the repairs carried out during their life are set out in the following table:

	Date "Lighted Up."	Date "Let Down."	Remarks.
No. 1 Bed	Nov. 16, 1911	Mar. 29, 1912	No repairs.
	Sept. 13, 1912	Aug. 10, 1913	Producer at clinker-line relined. New tar off-take fixed.
	Sept. 1, 1913	April 6, 1914	No repairs.
	May 6, 1914	Aug. 1, 1915	Producer at clinker-line relined.
	Aug. 22, 1915	April 1, 1916	Pulled out and re-set.
No. 2 Bed	Oct. 4, 1911	July 18, 1913	Producer at clinker-line relined. New tar off-take fixed.
	Aug. 11, 1913	June 21, 1914	No repairs.
	July 18, 1914	Aug. 22, 1915	Producer at clinker-line relined.
	Sept. 11, 1915	April 1, 1916	Pulled out and re-set.
No. 3 Bed	Oct. 4, 1911	June 13, 1913	Producer at clinker-line relined. New tar off-take fixed.
	July 19, 1913	May 2, 1914	No repairs.
	June 8, 1914	June 23, 1915	Producer at clinker-line relined.
	July 20, 1915	July 8, 1916	Pulled out and re-set.
No. 4 Bed.	Oct. 4, 1911	May 23, 1913	Producer at clinker-line relined. New tar off-take fixed.
	June 25, 1913	July 25, 1914	No repairs.
	Aug. 18, 1913	April 4, 1915	Producer at clinker-line relined.
	May 27, 1915	April 30, 1917	Pulled out and re-set.
No. 5 Bed	Oct. 28, 1911	April 16, 1912	No repairs.
	Oct. 1, 1912	April 1, 1913	New tar off-take fixed.
	June 2, 1913	May 29, 1914	Producer at clinker-line relined.
	June 24, 1914	May 22, 1915	Slight repairs to furnace lining.
	June 22, 1915	April 30, 1917	Pulled out and re-set.

Nos. 1, 2, and 3 beds were pulled out and reset during the summer of 1916, and the actual "working life" of these retorts was as follows:

No. 1 bed	1361 working days—	"let down"	four times
No. 2 ,,	1565 ,,	,,	three times
No. 3 ,,	1637 ,,	,,	three times

The total repairs to these settings during their life consisted in the renewal of a part only of the producer lining at the clinker-line (about 10 sq. ft. each producer) at the periods set out in the table. Each producer needed these repairs twice. The retorts were kept in good working condition by hot patching only; no repairs being carried out on the retorts while the settings were cold.

The total cost of resetting these three beds was £1011, which figure includes the labour for the dismantling and refixing of all ironwork after resetting.

The average ton-life of the three beds under review was 19,773 tons per bed; and the cost of resetting, &c., was therefore 4·09d. per ton of coal carbonized. This was with the prices ruling for materials in 1916, which were considerably higher than pre-war prices.

Nos. 4 and 5 beds were pulled out and reset during the present year; the actual working life being:

No. 4 bed. 1924 working days—"let down" three times.
No. 5 ,, 1715 ,, ,, four ,,

The total repairs to these settings during their life was to part of the producer lining only, as explained in connection with Nos. 1, 2, and 3 beds—the treatment being the same throughout. Here it may be explained that the three retorts of No. 5 bed were out of action altogether during the last six months the bed was working, on account of the ironwork of the mouthpieces being destroyed by the action of water dripping on to the setting from the overhead breeze hoppers. A new arrangement of discharge shoot has been fixed, which allows the water from the breeze to be drained away into a fall-pipe carried clear of the settings. While on this matter of corrosion, I may point out that almost immediately after the installation was put to work, it was thought that the action of wet breeze would soon destroy the hopper plates. The breeze hoppers, bottoms and sides were, therefore, protected by reinforced concrete on the inside; and this has given perfectly satisfactory results.

The total cost of resetting Nos. 4 and 5 beds, including the labour for dismantling and the refixing of all ironwork was £788. The average ton-life per bed was 23,403 tons; and the cost of resetting was equal to 4·04d. per ton of coal carbonized. This was with 1917 prices of materials, which were much higher than the prices paid in 1916. The average ton-life of our hand-worked horizontal retorts was 7000 tons; and the cost of resetting in pre-war times averaged 2·66d. per ton. So that, allowing for the greatly increased cost of materials and labour which applied during the time of the resetting of the vertical retorts, the costs of the latter compare very favourably indeed with the cost of the horizontals.

Previous to the introduction of vertical retorts with all the accompanying mechanical plant, hand-worked horizontals only were used; the coke being removed by barrow into the yard. To compare the charges against "Repairs and Maintenance of Works and Plant" before and after the introduction of verticals, I have taken the average of five years before and five years after, and these charges are as follows:

Repair and Maintenance of Works and Plant—Per 1000 C.Ft. of Gas Sold.

Before Verticals.		After Verticals.	
1907	2·53d.	1912	1·94d.
1908	1·62	1913	2·53
1909	2·28	1914	1·84
1910	2·23	1915	2·56
1911	3·41	1916	3·67
Average	2·41d.	Average	2·51d.

Periods of five years are perhaps too short to compare such important costs—particularly when we are confined to the period of five years immediately after the introduction of new plant, when repairs for the first year or two are at a minimum. We have to remember that, during the years 1915 and 1916, the costs of all materials were on an ever-ascending scale, and repairs could not be carried out during the period of the war at anything like pre-war costs. The 1916 figure includes the total cost of resetting the three beds of verticals, as previously detailed.

One item coming under the heading of "Repairs and Maintenance" is perhaps worthy of special note; and that is the actual working life of a hot-coke conveyor chain. The conveyor in use with our vertical retort installation is of the "D.B." type; and immediately on leaving the retort-house the trough rises at an angle of 27°, to deliver the coke through a rotary screen into the hoppers. The three chains already renewed have handled respectively 30,000, 27,000, and 19,500 tons of coke—an average of 25,500 tons per chain; and the first costs equal 1·28d., 0·98d., and 1·53d. per ton of coke carried, or an average of 1·25d. Prior to fixing the third chain, it was thought that to base the comparative life of a chain on the tonnage only was not quite equitable; so a mileage recorder was fixed, that ton-miles might be taken as the basis for future comparison. No. 3 chain ran 1580 miles, and carried 19,500 tons of coke. The first cost (£125) was, therefore, equal to 0·97d. per 1000 ton-miles. During the life of this chain careful notes were made as to the mileage run before any alterations to the driving sprockets were necessary; and these details have been of great value in determining the periods of alteration to sprockets during the life of the subsequent chain.

The coke conveyor trough was originally lined with renewable steel plates; but it was soon evident that the handling of these long plates for renewals was of such a character as to make repairs not only costly but almost impossible during the time at our disposal between retort-house shifts. We have, therefore, been using for some considerable time short cast-iron plates as a lining to the trough, and find that these are quite satisfactory in every way. The guide angles were also shortened to suit the lengths of the cast-iron plates, and fixed so as to break-joint with the plates. The ends of these short guide-angles are curved slightly upwards to prevent any tendency of the chain catching them.

There is one matter in connection with this intermittent vertical retort installation that has caused, and is causing us some little anxiety; and that is, the comparatively rapid—in some parts—corrosion of the structural steel work, caused by the steam generated by the quenching of the hot coke in the conveyor trough. Our own particular trouble is at the coke discharge end of the house, the structural steel work of No. 5 bed being exposed to the steam given off in the quenching of the coke from all the beds. This trouble was undoubtedly aggravated by local conditions, during the first three years of the working of the plant, as we were using for coke quenching water that was pumped from our work's well, fed by an Artesian bore—water of a very saline character. We have tried various paints on the main stanchions at this point, but with practically no success. Our best results as yet have been obtained by wrapping the stanchions with wire netting, and plastering about an inch of a mixture of cement and sand on the faces. But even this has not been entirely successful, due to the difficulty of obtaining perfect adhesion. The interior of all stanchions we filled with concrete shortly after the installation was put to work. I would suggest that in future work this protection of all exposed structural steel-work of the main stanchions, with concrete or otherwise should be carried out during the erection, and that a little more space be allowed by the builders to enable this to be done effectually.

The question of "Carbonizing Wages" I propose to treat over the same periods as "Repairs to Plant." "Carbonizing Wages" includes all costs from receiving the coal on the works up to and including the wages of boiler and exhauster attendants and also supervision.

Carbonizing Wages—Per 1000 C.Ft. of Gas Sold.

"Hand-Worked Horizontals."		"Verticals." [Part horizontals in use during each winter.]	
1907	3·99d.	1912	1·44d.
1908	3·70	1913	1·38
1909	3·94	1914	1·47
1910	3·60	1915	1·62
1911	3·08	1916	1·73
Average	3·66d.	Average	1·53d.

The increased costs for 1915-16 over the average of 1912-14 are due to war wages, and of course affect the final average. These figures are taken from our yearly working statements and may, I think, be left to speak for themselves.

DILUTION OF GASES.

The subject of dilution of coal gas has been much discussed lately and properly so. With intermittent vertical retorts, this dilution has been practised regularly, and the degree of dilution can be varied according to the time occupied in steaming the spent charge. Our own practice has been to steam the last two hours out of a twelve-hour charge. The best place to produce "blue" gas may not be in a vertical retort; yet we have made many trials—varying the duration of the steaming from the two hours' practice. We have not up to the time of writing arrived at any definite conclusion to upset our usual period of two hours' steaming; but we have proved that makes considerably over the figures already given, and of very good calorific value, are quite possible with prolonged steaming. But there are other things to consider—such as the effect of this prolonged steaming on the retorts, the probable deterioration of the coke, &c.—that have to be settled before putting this method into everyday use.

The question of auto-carburation first introduced, I believe, by the late Prof. Lewes is, I think, of importance in considering "dilution;" and I would like to see tried on a vertical retort installation, the introduction at the bottom of the retorts, of a "blue" gas preheated to the retort temperature, and in sufficient volume to keep the retort regularly swept free of coal gas, as quickly as this latter is produced, particularly during the first three or four hours of the carbonizing period.

This leads one to consider the most suitable plant for the manufacture of "blue" gas or slightly carburetted water gas. The twin-generator type of plant (without carburettor or superheater) will probably come into its own here, as with this plant it seems feasible to propose the use of any fuel oil, if desired, sprayed direct on to the top of the fuel in either generator. The twin-generators should be capable of being constructed at a fairly low capital cost based on the output. The control should be easy of manipulation; while the working costs, as far as one can judge, without an actual trial, ought to be such as could compare favourably with any other type of plant at present on the market.

The carburetted water gas plant in use at the East Hull Gas-Works is of the combined carburettor-superheater type, and has a capacity of one million c.ft. per diem. The plant was constructed by Messrs. Davison & Partner, of London. Duplicate blowers, driven by steam turbines are installed; and three oil and three water pumps are also fixed in the blower-house. All the pumps are of the same size, for convenience of interchangeable parts. The carburettor and superheater are filled with checker bricks of the Davison-Tooley patent design, which present a very large surface to the oil vapour. They are also fitted with thermo-electric pyrometers supplied by the Cambridge Scientific Instrument Company; the leads from four pyrometers being taken to a four-way switch, and thence to a direct-reading indicator of the galvanometer type. This method of control has proved very efficient; and the cost of the renewal of the thermo-couples is a very small matter.

The relief gasholder is some distance away from the plant, and out of sight. An indicator has, therefore, been fixed on the working stage; and thus at all times the operator can see at a glance the stock of gas in the holder.

A somewhat special feature in connection with this relief gasholder is that the oil-storage tank is constructed inside the gasholder tank—both tanks being of steel and all above-ground. The gasholder tank is 50 ft. diameter, and the oil-storage tank is 40 ft. diameter. In designing the oil-tank, consideration was taken of the fact that at times the tank may be empty or nearly so, while the annular space in which the holder floats remains full of water. Intermediate angle steel stiffening rings were fixed to the sides (inside) and braced by chords of round section adjusted by means of turnbuckles. The bottom curb of the tank was riveted to the bottom plates common to both tanks; an outer ring of radial plates somewhat thicker than the inner bottom plates being used for this purpose. The usual trussed covered roof was fixed over the oil tank; the centre post being lengthened so as to rest on the bottom of the tank. This prevents any deposit from the gas fouling the oil. We have allowed the crown manhole of the oil-tank to remain partly displaced, so that the gas pressure is directly exerted on the surface of the oil. The inner lift of the gasholder is provided with special crown-framing in the form of latticed steel curved girders; and when the holder is empty, these girders rest directly on the roof of the oil-tank. The outlet pipe of the gasholder is provided with an automatic valve, which consists of a weighted disc slung from the roof of the holder by a short length of chain—the edge of the outlet pipe being machined. When the holder is nearly empty this disc rests upon the outlet pipe, closing the latter off, and preventing any damage that might otherwise occur through over-exhausting.

This combined method of constructing the two tanks certainly saves ground space (which in our case was of the utmost importance), while the cost of construction, if not actually cheaper than the cost of separate tanks, does not exceed it. We have found no inconvenience arising from the construction named during the eighteen months the plant has been in use.

A TAR-INJECTOR USED.

Owing to the difficulty of obtaining supplies of gas oil, and the consequent high prices of it various trials have been made to use a substitute such as the coal tar oil referred to in the following table, and which has so far proved most efficient. A special tar-injector has also been added to the generator. This injector is constructed integral with the top steam supply to the generator; the steam supply surrounding the tar injector. Carburetted water-gas tar is injected into the generator on to the top of the coke on the down-runs only. In this way any carbon that may be deposited is consumed during the following blow, and is not deposited on the checker brickwork of the carburettor.

Analyses of the gases at the outlet of the washer during the down-runs when using tar average as follows:

CO_2	3·6 p.ct.	CO	37·6 p.ct.		
O	*nil*	CH_4	3·4 ,,	N	1 0 p.ct.
C_nH_n	0·3 p.ct.	H	54·1 ,,		

Calculated calorific value, 342 B.Th.U.

The tar is measured through a suitable liquid meter; and the average per run is about ¾ gallon per 1000 c.ft. of gas made.

The tar oil previously referred to tests as follows:

Specific gravity . . . 1·015 .. Flash point . . 147° Fahr.
First drop over at 104° C.—after water at 160° C.

Fractions.	Temperature.	Specific Gravity.	Per Cent. by Weight.	Remarks.
No.	Deg. C.			
1	194	·938	9·24	SH_2 very heavy
2	200	·962	9·47	,, trace
3	206	·976	9 61	,, very slight trace
4	212	·987	9·72	,, heavy
5	218	·993	9 78	,, ,,
6	225	·999	9 84	,, ,,
7	238	1·003	9·88	,, very heavy
8	255	1·009	9·94	,, ,, ,,
9	280	1·021	10·05	,, ,, ,,
10	314	1·035	8·47	,, ,, ,,

Water, 0·16 p.ct. Residue, 4 p.ct. Naphthalene, *nil*. Sulphur, 0·34 p.ct.

The average results obtained from a number of tests of this tar oil are as follows:

Gallons used per 1000 c.ft. of gas made = 1·38.
Calorific value of gas, 472 B.Th.U. (Beasley recording calorimeter).

Though the heating value of the gas is fairly good, the illuminating power is poor—only about 12 candles (No. 2 Metropolitan burner), and its composition is such that it requires less air for its combustion as compared with a gas made when using "gas oil" only. Altogether the trials were so satisfactory that it is the intention to continue the use of this oil, although, unfortunately, the supply is limited. Since the above tests were made, we have found it rather difficult to obtain this tar-oil, naphthalene free—the content varying with atmospheric conditions at the time of delivery.

INERT CONSTITUENTS IN GAS.

Reverting to the question of the allowable quantity of inert constituents contained in our gas supply, the effect of nitrogen on flame temperature has been pointed out on numerous occasions. Ought we not to consider the quantity of nitrogen contained in the combustible mixture as well as the percentage of nitrogen in the gas itself? Dr. Dunn in a very valuable paper contributed to the Association in October, 1915, said:

"Now flame temperature depends, not only on the amount of heat given by a cubic foot of gas, but on the amount of material on which the heat has to spend itself—that is to say, on the amount of the products of combustion. We must regard not only the gas as generating a certain amount of heat, but the amount of oxygen which is necessary and which shares in the generation of heat; and further, the quantity of nitrogen associated with the oxygen, and the amount of CO_2 and H_2O produced."

If we consider the combustible mixture and the question of nitrogen contained therein—whether the nitrogen is already in the gas in the free state or is introduced with the air required for combustion—the nitrogen must affect the flame temperature. I have collected for the purpose of comparison gases varying considerably in nitrogen content and also in composition; and the following table summarizes a few of the results. All the data are calculated from the analyses of the various gases.

It is interesting to note the percentage of nitrogen in the various combustible mixtures, as compared with the percentage of nitrogen present in the original gases; also the quantity of air required for combustion per 100 B.Th.U. of the gas. This latter may to some extent (other things remaining equal) be some indication of the value of the gas as regards flame temperature; seeing that the available heat of the mixture, for gases requiring the lesser air admixtures, is confined to a comparatively smaller volume of products than those examples requiring the larger volumes of air for combustion. This seems to be confirmed on calculating the temperatures to which the available heat could raise the products of combustion of the examples given in the table.

—	Calculated Calorific Value. B.Th.U.	Nitrogen in Gas. Per Cent.	Air needed for the Combustion of 1 C.ft. of Gas. C.ft.	Air needed for the Combustion of Gas per 100 B.Th.U. C.ft.	Nitrogen in the Combustible Mixture. Per Cent.	Nitrogen in the Combustible Mixture per 100 B.Th.U. Per Cent.	Volume of Products from 1 C.Ft. of Gas. Steam. C.ft.	CO_2. C.ft.	N. C.ft.	B.Th. Units ÷ Air + Gas = Thermic Value.	Comparative Flame Intensities. F.	—
a	306	3·7	2·26	0·74	56·1	18 3	0·511	0·452	1·825	93·9	3490	"Blue" generator gas.
b	416	4·3	3·20	0·77	61·3	14·7	0·718	0·499	2·573	99·0	3490	Lightly c.w. gas (tar-oil).
c	417	18 6	3·65	0·82	66·1	14·7	0·941	0·361	3·074	96·1	3108	Coal gas.
d	457	16·3	3·74	0·82	66·0	14·4	0·976	0·359	3·125	96·4	3098	Mixed coal and c.w. gas.
e	470	17·2	3·81	0·82	66·4	14·2	0·969	0·379	3·209	97·1	3160	Coal gas.
f	472	14·3	3·83	0·81	65 7	13·9	0·996	0 367	3·178	97·7	3150	Mixed coal and c.w. gas.
g	473	2·6	3·66	0·77	62·7	13·3	0·776	0·581	2·923	101·5	3563	C.w. gas (gas oil).
h	475	11·9	3·80	0·80	65·1	13·7	0·932	0·433	3·125	99·1	3280	Mixed coal and c.w. gas.
j	480	11·3	3·90	0·81	65·3	13·6	1·021	0·366	3·200	98·0	3160	,, ,, ,,
k	506	2·6	3·80	0·75	63·2	12·5	0·797	0·595	3·033	105·4	3740	C.w. gas (gas oil).
l	516	9·3	4·04	0·78	65·4	12·7	0·986	0·449	3·288	102 3	3397	Mixed coal and c.w. gas.
m	559	10·05	4·57	0·82	66·6	11·9	1·113	0·455	3·713	100·3	3270	,, ,, ,,
n	567	13·4	4·40	0·78	67·0	11·8	1·084	0·429	3·612	105·0	3447	,, ,, ,,
o	569	7·76	4·65	0·82	66·6	11·7	1·139	0·470	3·766	100·5	3260	Coal gas (verticals only).
p	570	2·13	4·30	0·76	64 6	11·3	0·875	0·646	3·424	107·5	3781	C.w. gas (gas oil).
r	586	5·35	4·71	0·80	67·5	11·5	1·164	0·490	3·860	102·6	3280	Coal gas (verticals only).

CALORIFIC VALUE AND FLAME TEMPERATURE.

There seems to be no definite relationship between the calorific value of these various gases and the comparative flame temperatures. While roughly grouping the examples under their calorific values, there are cases where a decided increase in the nitrogen content of the gas does not adversely affect the comparative flame temperature. The examples indicating the higher flame temperatures are those containing the greater proportions of CO and H. These simpler gases play an important part in the question of flame temperature, and they are also accompanied by a (comparatively) lower air-gas ratio than the more complex gases that go to the making-up of our gaseous mixtures.

Apart from theoretical considerations, in practice the mechanical and physical conditions at the point of combustion are important contributors to flame temperature as well as the composition of the gas consumed.

Considering the uses to which gas is put at the present time—for cooking, heating, and industrial purposes generally—what is required is a cheap supply of B.Th.U.; and for incandescent lighting and welding purposes (which require a maximum flame temperature), I think, the same general reasoning will be found to apply. The maximum calorific value-ton multiple is what we should strive to attain. Such gas should be fairly constant in composition, of certain constant specific gravity, and delivered at a constant pressure. Whether we have reached the lowest limit of calorific value in what is recognized as the present-day standard to satisfy the above requirement is, I believe, doubtful.

The limitations of time and opportunity have prevented more work in this direction being done personally; yet, perhaps the few figures I have ventured to lay before you may not be without interest. We expect to hear a good deal more about this subject from the Fuel Research Board and the Gas Investigation Committee of the Institution of Gas Engineers, when their labours are sufficiently far advanced to allow of conclusions being drawn therefrom; and we await their publication with the hope that they will finally clear up a controversy round which there has been much speculation.

NO DUAL TESTING.

One thing we as an industry do not want, and which we ought to see is not imposed upon us, is any plurality of testing. This leads to a multiplication of expert examiners, to needless complications (as already instanced in some cases of the dual testing for illuminating po wer and calorific value), and it tends to hamper manufacture and to increase costs. We do not want any repetition of this kind. Let there be one test for the quality of gas, whatever the test may be.

NITROGEN CONTENT OF DIFFERENT COALS.

Bearing on the question of nitrogen content, it is not quite clear as yet the quantity of free nitrogen given off from our various coals during gas making and under different gas making conditions, or from the coke during the steaming period for the making of "blue" gas; but figures that have already been published by various workers (notably the researches of M'Leod and Davidson) indicate that only about 1 p.ct. of the nitrogen found in the straight coal gas is directly due to the nitrogen content of the coal under the conditions in which the various researches were carried out.

RESEARCH WORK.

May I digress on the subject of research work, and emphasize the difficulty of "bridging" between pure laboratory experiments and practical working results. A few years ago I was connected with a chemical process where it could be demonstrated in the hands of a capable chemist that it was possible to obtain certain results; yet in practical working, these results were never even approached. The difficulty is to control chemical reactions on a working scale, where probably some little factor (not present in the laboratory experimental work) is sufficient to upset months of careful preparation. This experience brought home to me very vividly the importance of co-operation as well as research.

FUTURE OF THE GAS INDUSTRY.

Mr. Longridge in his address to the Institution of Mechanical Engineers a few months ago said: "Mechanical engineering to be efficient must be independent; and to be independent it must have some powerful representative body to decide and voice its policy." Substitute "gas engineering," in its widest sense, for "mechanical engineering" and the same proposition may with equal force be applied to our own particular industry. But unfortunately, our "powerful representative body" has not yet materialized. May we hope that in the near future such a representative body will begin to make itself felt for the benefit of our industry? Surely there is already the material for the making of such a body; but let it be "representative" in the fullest sense of the word, and not merely representative of a certain section or sections only. Without such a representative body, how can the gas industry hope to command attention to such questions as have been prominent of late? Take the depreciation of capital for example. Not only is there need for a revision of the sliding scale, but maximum dividends also require revision. Surely all capital should be able to maintain at least a fair earning power; and as dividends are subject to heavy income-tax deductions, and the recipients of the dividends are also affected by the reduced purchasing power of money, it is only just to ask for some revision, so that gas companies' capital may be brought more into line with that of other companies generally, and allow the investors in gas stocks a fair return, based upon present-day conditions, on their investments. A correspondent in the "GAS JOURNAL" a few weeks ago said: "If the South does not move, the North will." But why should the North wait to see if the South is going to move? This will not be the only good thing that has emanated from the North; yet here is another lamentable instance of the lack of that "truly representative body" that has yet to be evolved from the chaos of present conditions.

Under the pressure of abnormal circumstances in which we have been living of late years, are we, as gas manufacturers primarily, in danger of forgetting the importance of our primary commodity, gas? It has been said that we are becoming manufacturers of bye-products, and that these bye-products will eventually assume the position of staple products. While not underrating the value to our business of these bye-products, yet my experience during the last three years is, that of our residuals only one has held an all-important position in contributing to the credit side of the balance-sheet, and that is coke. The value of tar, which to the nation in these times is inestimable, has depreciated to my Company to the extent of over 50 p.ct., and occasionally there has been a real difficulty in getting rid of it at any price. However there are indications that the gas industry is at last taking this question seriously; and we are hoping that bye-and-bye tar will "come into its own," and incidentally bring with it that share of profit to which I think we are justly entitled.

As to sulphate of ammonia (the fertilizing value of which to the nation needs no commenting upon), the commercial value of this important bye-product to the manufacturer has nearly reached vanishing point. It has been "controlled" until its value to a gas undertaking balance-sheet is in danger of disappearing altogether from "credit."

One cannot help thinking that in these matters, statutory controlled gas undertakings have not been treated with the fairness that the position occupied by such undertakings in the industry of the nation deserves.

It is not likely that, for many years after the termination of the war, prices of coal, oil, structural materials, and labour will reach their pre-war level—if, indeed, some of them ever again reach such rates; and on this score we are hoping that the development of our products will to some extent contribute to these seemingly, permanently increased charges.

This development of our products, primary and secondary, will tend to economic independence, which is of much importance to an industry as it is on the larger scale national and imperial; and it is consistent with true economy that we should make use of our own resources.

I have to apologize, Gentlemen, for the omnifarious nature of this address; but although it is difficult in these times to concentrate one's thoughts and attentions on such matters, yet the labour has been a "labour of love," and as such I ask you to accept it.

Mr. HAROLD H. COLLETT (Leeds) then read a paper on "Some Experiences with Intermittent Verticals"—see p. 72.

On the proposal of Mr. N. S. COX (Sunderland), seconded by Mr. J. KELLY (Bridlington), a hearty vote of thanks was accorded to the President for his address and to Mr. Collett for his paper.

Lantern Lecture on House Lighting.

The American Illuminating Engineering Society have prepared a second of their series of illustrated popular lectures; this one answering the question "How Shall I Light my Home?" There are 45 lantern slides to accompany the lecture, which covers in detail and in an authoritative manner the specific requirements for home lighting installations, combining the scientific, artistic, and psychological principles, but stating these requirements in non-technical language for popular audiences. The applications of the fundamentals of home illumination are taken up: First, with respect to the colour, quality, intensity, and direction of the light from the illuminant. The correct applications of daylight illumination are also considered. Second, the necessary equipments for porches, hall-ways, reception halls, libraries, dining rooms, bedrooms, parlours, closets, bathrooms, kitchens, basements, laundries, &c., are described and illustrated. Considerable space is given to the functions peculiar to each part of the home; and details of the corresponding illumination requirements are described. Third, the fixtures and glassware suitable for home use are covered in paragraphs dealing with diffusion, reflection, absorption, and the decorative characteristics of available types. Descriptive lantern slides illustrate these characteristics. The lecture, as does the earlier lecture on "Store Lighting," is quite neutral as regards artificial lighting by gas or electricity.

Control of Petroleum.—The War Cabinet have requested Mr. Walter Long, M.P., to take control of all questions affecting petroleum oils and petroleum products. His Technical Adviser will be Prof. Cadman, C.M.G., the Petroleum Adviser to the Colonial Office and Professor of Mining of the University of Birmingham. "The Times" understands that the Government have under consideration the necessity of fixing maximum prices for petrol, kerosene, and other petroleum products, and that an announcement that such action has been taken may be expected shortly.

SOME EXPERIENCES WITH INTERMITTENT VERTICALS.

By Harold H. Collett, of the Meadow Lane Gas Works, Leeds.

[A Paper read before the North of England Gas Managers Association.]

Although vertical retorts of the present-day type are still in their infancy as compared with other systems of carbonization, many papers have been written concerning them; for it is only natural that interest should centre round the most recent product of the carbonization "melting pot." The majority of these papers, however, have dealt mainly with the constructional side and the working results. It is proposed, therefore, to confine this paper more to the experiences gained, and the difficulties met and overcome, in connection with the practical working of the intermittent type of vertical retorts—particularly with reference to the condition and temperature of the gas.

Earlier Designs of Verticals.

In the earlier designs of intermittent vertical retorts, there were usually ten retorts per bed, arranged in two rows. Each retort is discharged and charged separately, although in some plants, two adjacent retorts—one in the front row and one in the back row—are charged in one operation by a special shoot. Each retort has its own gas take-off pipe, 6 in. diameter, to which fact special attention is drawn for reasons to be given later. These take-off pipes require cleaning once or twice per week; and if this is done from two to three hours after charging, the tarry matter in them is in a "buttery" state, and is very readily and easily dealt with. As the temperature in the hydraulic is about 60° C. (140° Fahr.), there is no trouble, of course, with pitching-up; and any heavy tarry matter dropping down the dip-pipes is collected in the hydraulic mains by means of pitch-pans, which are cleaned-out every seven to ten days. Ammonium chloride, with all its attendant troubles, is unknown in this type of plant; for the reason that the temperature of the gas leaving the hydraulic main is so much below the dew-point that there is no possibility of the salt settling in the mains in a solid form.

Later Designs of Verticals.

The later designs of intermittent verticals for large gas-works have eighteen retorts in each bed, arranged in three rows. Three of the adjacent retorts—one in each row—form a set, and are discharged and charged in two distinct operations. The whole of the gas from each set of these retorts is taken off to the hydraulic main through one 6-in. pipe. There are also 6-in. pipes connecting the front retort to the middle retort, and the middle retort to the back retort; and the gas from the back retort must on its way to the hydraulic main pass through the mouthpieces of the middle and front retorts, and that from the middle retort through the front mouthpiece. Thus there are only six take-off pipes, 6-in. diameter, for eighteen retorts, which, in comparison with the setting of tens previously described, is a reduction in the cross sectional area of the take-off pipes of no less than 66 p.ct. to deal with an increased quantity of gas amounting to 55 p.ct. These pipes were much too small, and being overworked, made-up rapidly; and as the temperature of the gas passing through them was so high, the tar deposits were always hard and dry, which made the cleaning very arduous work. The hydraulic mains pitched-up readily; and the gas up-take pipes from the hydraulic main to the foul main became blocked with pitch and ammonium chloride, as did also the foul main itself. Ammonium chloride stoppages revealed themselves up to, and even beyond, the retort-house governor.

From this short comparison, it will be seen that there is a considerable difference between the working conditions of the earlier and later designs; and the difficulties which arise in the latter resolve themselves largely into a question of temperature, owing to the greatly increased make of gas per bed. The retorts in the settings of eighteens are about 4 p.ct. smaller than those in the settings of tens; the daily carbonizing capacity of the former being 16 tons of coal per bed, and of the latter 9¼ tons per bed.

Experiences at Leeds.

At the Meadow Lane works of the Leeds Corporation Gas Department there are now two benches of intermittent vertical retorts, each having a nominal capacity of one million cubic feet of gas per twenty-four hours, the first of which was put to work in December, 1913, and the second in April, 1916. In the first bench pitching-up troubles occurred in the hydraulic mains at an early stage, and reciprocating agitators were fitted inside them, in order to keep the contents in constant motion, so as to prevent the formation of pitch. This did not overcome the trouble; and it was necessary, in order to continue gas making, to lay-off the mains one after another to clean them out and free the agitators—an operation that took several days for each main.

Constant trouble was experienced with stoppages in the gas up-take pipes; and the foul main was in places nearly made-up solid with pitch and chloride. Finally, one afternoon a complete stoppage, caused by ammonium chloride, occurred in the foul main on the outlet side of the retort-house governor, at a point about 94 ft. beyond the end of the bench.

It may here be remarked as an interesting and curious fact that heavy deposits of tarry matter and ammonium chloride crystals contain about 50 p.ct. of the latter. Samples have been taken at different periods; and the analyses of these have given figures which vary by only 10 p.ct.

Methods Adopted for Overcoming Difficulties.

These difficulties were tackled one after another by the following methods. As the hydraulic mains were cleaned out, a tar feed-pipe was fitted to each one; and a circulation of tar was set going through them. This kept the mains clear, and very largely overcame the pitching-up trouble. The foul main was fitted with a series of ten liquor supplies, two to each bed; and a constant stream of liquor was pumped through them into the main. The liquor ran down the up-take pipes into the hydraulics. This circulation of liquor had a very prompt and marked effect upon the stoppages in the foul main, and also those in the up-take pipes. The chloride stoppage beyond the retort-house governor was also treated with liquor, which dissolved the salt, and which was afterwards removed from the syphons in the usual way, along with other condensed matter. By these means, the mains were gradually cleared, and were afterwards kept clear; and a marked improvement in the working results was obtained.

Tar Circulation.

The tar circulation in the hydraulic mains, although proving very beneficial, was by no means an unmixed blessing; since if any stoppages occurred in the seal pots at the end of the mains, the tar overflowed, and the extra seal put pressure on the retorts, causing the bottom doors to flare, which set fire to the overflowing tar. One of these fires, which occurred after the motor driving the agitators had been restarted, following the usual stoppage during an air-raid, was so fierce and lively that the fire brigade had to be called in to deal with it. The gas up-take pipes were badly cracked, and a portion of the foul main and one of the bench buckstays were distorted. The bed on which this occurred, and also the part of the foul-main affected, were isolated, and gas manufacture was resumed on this bench in a few hours. After this the tar circulation was abandoned, tar towers of the "Nelson" pattern were fitted at the end of each hydraulic main, and a liquor circulation was substituted in place of the tar.

Two-Shift v. Three-Shift System.

The first bench was worked for over two years on two eight-hour shifts per twenty-four hours system; but this was altered later to the three eight-hour shifts per twenty-four hours system, and the "rounds," or "draws," were taken every four hours, so as to bring them into line with those on the second bench of verticals. It was most interesting to find that, after this alteration had been made, the ammonium chloride stoppages which, if for any reason the liquor circulation was stopped, still showed themselves beyond the retort-house governor, gradually worked-back until no trouble was experienced beyond the portion of the foul main immediately at the end of the bench. It was found that the charging of the retorts at regular and equal intervals had had the effect of lowering the general temperature of the gas, with consequent reduction of the chloride stoppages.

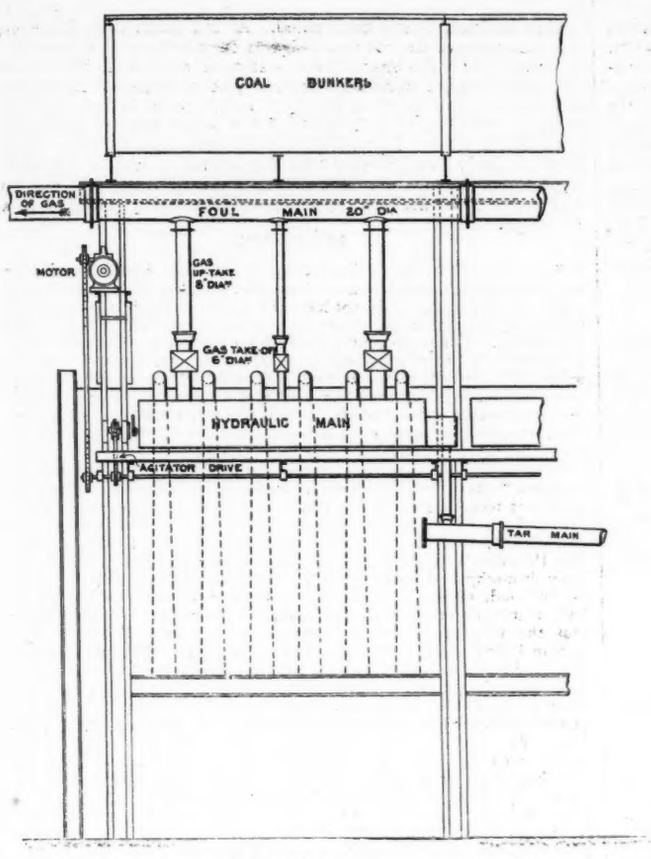
Modifications on the Second Bench.

Before the second bench was erected advantage was taken of the experiences gained with the first bench to greatly modify the design by increasing the superficial area of radiation surface in the various pipes, with a view to reducing the gas temperatures by atmospheric cooling.

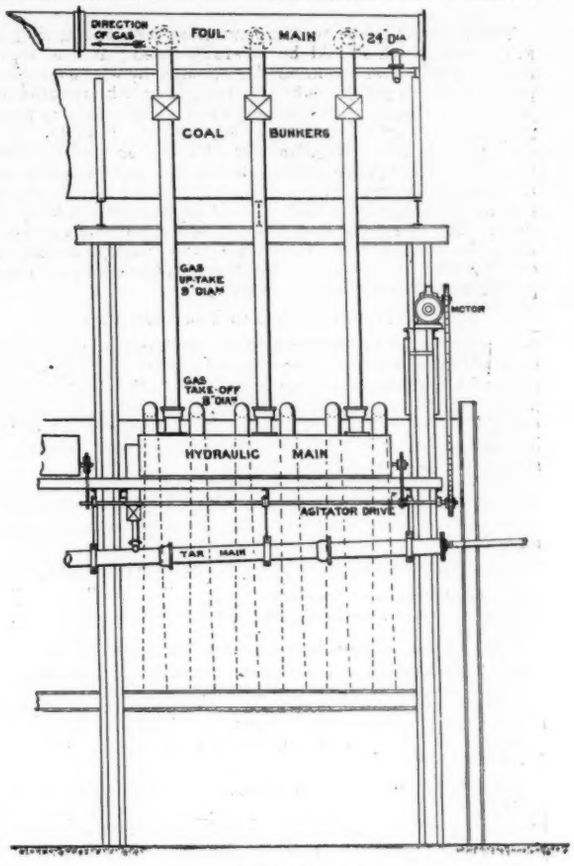
The gas take-off pipes from the retort to the hydraulic main were enlarged from 6 in. to 8 in. diameter. Hydraulic mains of the design shown in the accompanying drawing, and patented by Messrs. W. B. Leech and C. R. Payne, were fitted.* In these mains dip-pipes are abolished; and the gas from each section of three retorts is delivered into a chamber formed by cast-iron diaphragm plates fixed across the main. There is also a chamber similarly formed below each of the three up-take pipes, each of which takes the gas from two sections or six retorts. The diaphragm plates, which are all one depth, extend from the top to about half the total depth of the main, and dip into liquor, which is maintained at such a level as will seal these plates 1 in. A form of anti-dip valve is fitted to each of the diaphragm plates forming the sides of the chamber below each up-take pipe. It consists of a slide covering or uncovering an opening in these plates. This slide is raised or lowered by means of a spindle communicating with a hand-wheel outside the main. When the slide is raised, the opening is uncovered, and the gas is free to travel direct from the retort to the up-take pipe. When the slide is lowered, the opening is covered; and this section of the hydraulic main is isolated, and can if necessary be opened out for inspection or cleaning purposes, without any interruption of gas-making in the other sections. The agitator in the hydraulic main was retained, but made rotary instead of reciprocating, and was fitted with helical blades, in order to sweep any pitchy matter along to the outlet end of the main. A "Nelson" tar tower was fitted at the end of each main for flushing purposes.

Instead of two 8-in. diameter gas up-take pipes as fitted in the first bench, three of 9-in. diameter were provided; so that each one served six retorts. This alteration gives an increase in cross

* These were the illustrations used in the "Journal" for Aug. 1, 1916, (pp. 210-11), in a description given by Mr. Leech of the intermittent vertical retorts at Leeds.—Ed. "G.J."



No. 1 Bench.



No. 2 Bench.

sectional area of 90 p.ct. These pipes are made of steel throughout the greater part of their length; and each one is fitted with a valve fixed just before its junction with the foul main.

The foul main was raised 12 ft., and the up-take pipes were taken more into the side of the main than direct into the bottom, in order that liquor or any condensation could run along the bottom of the main from end to end. The foul main was increased in diameter from 20 in. to 24 in., and was given a fall against the travel of the gas. Arrangements were made so that a supply of liquor could be kept running down each up-take pipe.

Effect of Modifications on the Second Bench.

The effect of these alterations has been such that no ammonium chloride stoppages have shown themselves in the up-take pipes; and the foul main has always been perfectly free from any deposits. The retort-house governor for each bench is situated 70 ft. away from the outlet end. On the first bench, owing to the small size of the take-off and up-take pipes, it was always necessary to maintain a vacuum of 3-10ths on the foul-main at the outlet end of the bench, in order to give a vacuum of ½-10th on the retort. On the second bench, owing to the increased size of the pipes and mains, there is never more than ½-10th difference in vacuum between the inlet of the governor and the retort; while in the portion of the foul main along the bench, there is actually a pressure of 1-10th, which serves to show how clear are the pipes. The agitators worked well for some time, but later became practically solid with pitch between the blades—eventually resolving themselves into rollers, to the detriment of the agitation of the contents of the main. In these circumstances, if the agitators had to be stopped for any length of time, it was difficult to restart them; and, one by one, the ends of the shafts outside the mains were bent, which rendered them useless. The agitators have now been removed; and by regularly flushing the mains, and cleaning out each of the chambers once a week, no further trouble has been experienced.

When the question of increasing the size of the gas take-off pipes from 6 in. to 8 in. diameter was being discussed, it was thought that the larger pipes might mean much harder work in cleaning. But the contrary has proved to be the case. The deposits in them are so much less that the cleaning, which is done immediately after the retort is opened for discharging, is a comparatively easy matter. Then, again, the absence of dip-pipes has reduced the work of cleaning, and has eliminated stoppages. The sealing slides or anti-dip valves have worked very well, and have proved extremely useful when it has been necessary to isolate one section of retorts; and as this is done without interference with the other five sections (fifteen retorts), the gain is obvious.

Gas Temperatures.

The temperatures at several points from the hydraulic main to beyond the retort-house governor on both benches have been taken on various dates, and are as follows:

—	No. 1 Bench.			No. 2 Bench.	
	Oct. 1914. (*a*)	May 1915 (*b*)	May 1916. (*c*)	May 1916. (*d*)	Aug. 1917. (*e*)
	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.
Take-off pipes	..	385	..	..	..
Uptake pipes (bottom) . .	190	184	170	..	175
Foul main (end of bench) .	133	112	105	83	83
,, (at governor) . .	110	90	85	80	75
,, (beyond governor)	..	90	85	76	71

Column (*a*) gives the temperature on No. 1 bench when working two eight-hour shifts per twenty-four hours, but with no tar circulation through the hydraulic mains, or liquor supplies into the foul main.

Column (*b*) gives the temperatures on No. 1 bench when working two eight-hour shifts per twenty-four hours, but with a tar circulation through the hydraulic mains, and liquor supplies into the foul main.

Column (*c*) gives the temperature on No. 1 bench when working three eight-hour shifts per twenty-four hours, with tar circulation and liquor supplies as (*b*).

Columns (*d* and *e*) give the temperature on No. 2 bench when working three eight-hour shifts per twenty-four hours, with liquor supplies down the up-take pipes and into the hydraulic main.

The difference in the temperatures in columns (*b* and *e*) shows the beneficial effect of the regular charging of the retorts under the three eight-hour shift system. The lower temperatures in columns (*d* and *e*) show very clearly the reason for the marked absence of any stoppage in the up-take pipes and foul main on No. 2 bench, and also the improvement effected by the modified design.

Ammonium Chloride.

If ammonium chloride stoppages are to be avoided, the temperatures of the gas must be brought down to the dew-point, which will be in the neighbourhood of 80° C., but which will vary slightly with different coals. A rapid condensation of the gas to below this temperature is, therefore, necessary as soon as possible after it leaves the retort; and the means for effecting this will, of course, vary with different types of carbonizing plant.

Two important actions occur as a consequence of the circulation of liquor: (1) The high temperature of the hydraulic main rapidly converts the water into steam; and the latent heat absorbed from the gas in this conversion is mainly responsible for reducing this temperature. (2) The dew-point of the gas is raised; and this, coupled with the general cooling, is the reason for the absence of chloride deposits.

The action of latent heat in connection with the cooling of the gas is one which should be carefully noted; and, at the same time, it must be remembered that, though by its means the temperature of the gas in the hydraulic main may be reduced over a wide range, owing to the formation of steam, there is probably very little extraction of heat as expressed in B.Th.U. If, however, there is later a large amount of radiation surface offered to the gas for atmospheric cooling, it will be found that, at the lower temperature of the gas roughly corresponding to the dew-point, there will be very little cooling effect as measured in temperature drop. But there will be a large extraction of heat expressed as B.Th.U., which will be dissipated to the atmosphere during the condensation of the steam. In this way, therefore, are the temperature conditions finally levelled-up.

Radiation from Gas Take-off Pipes.

The increased temperature in the hydraulic mains of the settings of eighteen retorts, as compared with the settings of tens, or even with horizontals, is very largely due to the short gas take-off pipes, and the consequent reduction in the surface available for the dissipation of heat by radiation. Each pipe in the eighteens has also to deal with a larger amount of gas, which means a correspondingly increased velocity.

A comparison between the available radiation areas of the gas take-off pipes in intermittent verticals and the ascension pipes in horizontals is interesting from this point of view, and gives the following figures:

Intermittent verticals (settings of 18)	0·35	sq. ft. per 1000 c.ft. per 24 hrs.	
,, ,, (settings of 10)	1·30	,,	,,
Horizontals (one ascension pipe)	2·10	,,	,,
,, (two ascension pipes)	3 66	,,	,,

The above figures are based upon the following data:

Intermittent verticals (settings of 18). Twelve-hour charges of 8·86 cwt. per retort. Make per ton, 14,000 c.ft. of gas.

Intermittent verticals (settings of 10). Twelve hour charges of 9 cwt. per retort. Make per ton, 13,000 c.ft. of gas.

Horizontals. Make per mouthpiece, 7500 c.ft. of gas. Make per ton, 12,500 c.ft. of gas.

A striking confirmation of the cooling effect of longer take-off pipes is shown in figures published by Mr. Charles Dru Drury in his paper on "Intermittent Verticals" read before the Institution of Gas Engineers in 1911. These figures were obtained upon a bench containing six settings of ten retorts, and having a separate take-off pipe to each retort, as described above. The front retort has a short take-off pipe and the back retort a long one. The temperatures, which are the averages of hourly temperatures taken throughout a twelve-hour charge, are as follows:

	Retort Lid.		Bridge Pipe.	
	Degrees Fahr.	Degrees Cent.	Degrees Fahr.	Degrees Cent.
Front retort	748	398	253	123
Back retort	804	429	176	80

The gas from the back retort, although 31° C. higher in temperature than that from the front retort, as taken at the retort lid, is 43° C. lower at the bridge-pipe, showing the cooling effect given by the longer take-off pipe.

Intercepting Tank.

The hydraulic mains are regularly flushed, and the contents pass along the tar mains to an intercepting or scum tank, which is constructed so as to prevent any solid matter passing into the tar and liquor cellars. The outlet is covered by ¼-in. wire mesh to catch any floating matter. This tank is cleaned out every day; the deposit being readily removed by a shovel with a long handle. Each tar main, before it enters the scum tank, is provided with a valve, which has been found very useful at times. One scum tank was first fitted to take the overflow from the hydraulic mains of both benches. But this was found to be rather small to deal with the rush of liquor when the hydraulics were being flushed; so a second tank was added. Although both tar mains are dead—*i.e.*, under ordinary circumstances no gas can get into them—as a precaution, the ends of the mains were sealed in the scum tank.

As was remarked before, verticals are only in their infancy, and finality of design has not yet been attained, although with intermittent verticals it can now be said that standard conditions have practically been reached with regard to the construction of the setting, and the control of the retort temperatures. As to the methods of taking the gas away from the retorts, there is undoubtedly room for improvement; and it is on these lines that further modifications will probably in future take place, which, if properly carried out, will lead to greatly improved results. From alterations in designs which have been observed to have taken place in other systems, it is evident that this question of gas temperature is not peculiar to the intermittent system—in fact, one can hardly see how it could be otherwise.

Conclusion.

In this paper an endeavour has been made to place before the Association a frank statement of experiences with intermittent verticals, in the hope that it may prove to be of assistance to others who may have had similar troubles; for it is but a truism to say that more can be learnt from the difficulties, troubles, and sometimes failures which have to be faced, than from the routine which is smooth and untroubled. At the same time, however, because more of the rougher side has been presented, it must not be thought that the intermittent system of verticals is blessed or cursed with more difficulties than any other system. Now that the temperature question has been largely solved, there is very little trouble indeed at Leeds, and the whole plant works most smoothly day after day with almost monotonous regularity. This is particularly so with regard to the second bench; and modifications have been made this summer to the up-take pipes and the foul main on the first bench, which will be making gas again in a few days.

DISCUSSION.

The President (Mr. Richard Nelson) said they had listened to a very interesting communication from Mr. Collett. It was a type of paper of which they could not have too many. The recounting of experiences, not necessarily successes, was the means of spreading real knowledge. The paper had not only been interesting; but it would be of future value, more particularly to those members who had to deal with similar installations. It took a considerable amount of courage to admit that anything they had tried had not been the success which they anticipated, even if applied to details only; but if more of this was done, there would be no need for repeated failures. Mr. Collett truly said that "more could be learned from the difficulties, troubles, and sometimes failures than from the routine which is smooth and untroubled." He thought they might assure Mr. Collett—if such assurance was necessary—that his labour would not have been in vain; they had gained through his experiences. The paper dealt with settings of eighteen, with a daily carbonizing capacity of about 16 tons per bed. The President's experience was confined to settings of eighteen, with a daily throughput of about 13 tons. The East Hull retorts, although, he believed, of the same length as those dealt with in the paper, had a smaller cross sectional area. This would probably mean that the velocity of the gas passing through the off-take pipes—6-in. in both instances—was less in the case of the East Hull settings than in those described by Mr. Collett. Mr. Collett's experience of hydraulic mains being pitched-up readily and the gas up-take pipes from the hydraulic main to the foul main blocking with pitch and ammonia chloride had, he was glad to say, not been repeated in his case. This was probably due to the coal carbonized. Mr. Collett mentioned that, after the introduction of tar circulation, the mains were kept clear; yet, at the same time as the tar circulation was introduced, liquor was fed into the foul main, overflowing into the hydraulic main, through the medium of the gas up-take pipes. Should the credit of keeping the mains and connections clear not be given entirely to the circulation of the liquor? They had had one experience at East Hull due to tar-circulation. With others, they believed they should derive some benefit by doing this. The tar connections were laid on to each hydraulic main; the tar being to some extent pre-heated before reaching the hydraulic main. Within two or three days after the commencement of this tar circulation, they had every tar connection and main in the house completely choked up; and quite a lively time they had to get things back to normal. Their first experience of trying to make the hydraulic main do the work of a tar-still would, he was sure, be the last. Mr. Collett mentioned that, after two years' experience of the working of the two eight-hour shifts per twenty-four hours' system, they altered this to the three eight-hour shifts per twenty four hours' system. Mr. Nelson said he took it that the main reason for doing this was to try and lower the general temperature of the gas, and not to any inherent defect of the first system. Experience gained at East Hull during six years' continuous working of the two eight-hour shifts per twenty-four hours' system was so satisfactory that they had no reason for wishing a change. They were, of course, rather differently situated as compared with works like Mr. Collett's at Leeds. They had only one vertical house; and they found that the time between the two shifts was invaluable for the purpose of repairs to the conveyor trough, chain, or the adjustment of other gear. Where there were two or more houses, as at Leeds, it was possible to shut-down one house altogether during the summer to effect any repairs necessary for comfortable working in the winter; but with one house only, this could not be done. Again, under present-day conditions, in his town especially, the two eight-hour shifts per twenty-four hours' system had great advantages over the three eight-hour shift system. In fact, at present, their shift did not take up the eight hours. They commenced at three o'clock in the morning and afternoon; and the whole of the work was got through as expeditiously as possible—being completed about nine o'clock. All the work of each shift was done therefore in about six hours. Mr. Drury had proved some years ago that it was possible to obtain a practically straight-line chart on a recording calorimeter on the outlet of the gas-holder, even with a varying chart on the inlet; and it had been, and was, their continued experience at East Hull. They had two recording calorimeters, both connected so that they might take continuous records of: (*a*) Inlet gas to the holders; (*b*) gas on the district—this being brought into a side entrance of the works after it had travelled nearly half a mile from leaving the station governors; and (*c*) carburetted water gas as being made. Working as they were compelled to at present, there was no difficulty in obtaining a practically straight-line chart with the gas supplied to the district. They therefore considered that the two eight-hour shifts per twenty-four hours system had been of service to them in more ways than one. Mr. Collett had said that on the second bench they worked with a pressure of 1·10th in the foul main. It would be well to know just what pressure there was on the bottom mouthpieces under these conditions. It was interesting to learn that, after an extended trial of mechanical agitators in the hydraulic main, the agitators had now been removed. Mr. Nelson was never enamoured of mechanical agitators for hydraulic mains; and this was confirmed on seeing a solid block of pitch that had been cut out of a hydraulic main fitted with agitators. It was only fair to say, however, that this was not at Mr. Collett's works. He had always held, and was still of the opinion, that if any solid particles were going to be carried over with the gas into the hydraulic main—and it was difficult to see how this could be prevented with verticals—it was best to collect these solids at once and remove them, and not give them the opportunity of

causing trouble elsewhere. They continued the use of the pitch-pan as being the simplest method of dealing with these solids. He noted with interest that, in Mr. Collett's case, a scum or intercepting tank was used for a similar purpose; yet the speaker thought that to get rid of this solid matter at once was the better method. It was not costly to do. They had two men, working only one eight-hour shift in the twenty-four hours, responsible for scurfing and patching all retorts, augering all pipes regularly once per day, and doing the various other work that was essential on the top of the retort-bench, other than actually charging the retorts; and they yet found ample time to empty all pitch-pans once every day and to remove the pitchy deposit from the retort-house to the boilers. In connection with the anti-dip arrangement in use at Leeds, he would like to know if the disc-valve fans were quite gas tight after working some length of time. He could not see from the sketch reproduced that there was any "wedge" action to assist in keeping the working faces together. Did Mr. Collett find these valves safe enough to rely upon without the assistance of (say) blocking-up the gas outlet from the retorts, as was customary, with a fire-clay block, when a set of retorts was isolated for scurfing? Was there any trouble with the glands through which the spindle passed? He had always considered that the hydraulic main was far from being the ideal place to have more working parts than was absolutely necessary; but if these objections had been overcome, then the anti-dip arrangement, as shown, seemed to be a valuable addition. He must congratulate Mr. Collett on the success he had attained in the reduction of the temperature of the gas in the foul-main on the No. 2 bench, as compared with the No. 1 bench. This showed the influence of the modified design of the up-take pipes. Their average temperatures at East Hull, recently taken, were: At the take-off pipes, 390° C.; at the bottom of the up-take pipes, 99° C.; at the end of the foul main, 90° C.—showing a temperature drop of 290° C. between the take-off pipe and the up-take pipe, and 300° C. difference between the take-off pipe and the end of the foul main. Their temperature, therefore, at the foul main was 52° C. lower than the No. 1 bench at Leeds under column (*b*) conditions—that was, both working the two-shift system—and only 7° C. higher compared with the Leeds No. 2 bench under columns *d* and *e*; while comparing East Hull with the two eight-hour shift system with the Leeds No. 1 bench working under the three eight-hour shift system, they still showed a lower temperature by 15° C. It was evident, therefore, they had not had the temperature range to deal with at East Hull that Mr. Collett had had on No. 1 bench at Leeds.

Mr. T. SETTLE (Leeds) said he must first thank the President for his (the speaker's) attendance there that day, and also for the privilege of joining in the discussion. It seldom fell to the lot of any Association to listen to such a rich combination in the linking-up of a presidential address with a paper jointly bridging-over six years' life of wear and tear and costs of one installation with four years' mixed working of a second one, and one-and-three-quarter years' very successful experience of a third installation. The after-blessings attending such frank admission as Mr. Collett had given remained. He hoped that there would be less secretiveness in the future in regard to difficulties encountered rather than flourishing accounts of short-lived successes in carbonization. The speaker had shared somewhat of the experiences at the Meadow Lane works. There were invited troubles, as well as uninvited ones; and while the latter left no choice, the former unavoidably ended in a sure and permanent remedy—in that, so far as Leeds was concerned, Mr. Collett was able to tell them that the plant worked most smoothly day by day, with almost monotonuous regularity. There was no doubt whatever that the adoption of larger areas, in extended number and length, aided by plentiful liquor supplies, had played a most important part in reducing the temperature of the gas coming from the retorts. The dew-point of the gas had been brought back to the hydraulic main; and, consequently, ammonia chloride deposits, they were told, had disappeared altogether. Mr. Collett had very aptly described the modification and improvements that were embodied in No. 2 bench, and as being largely responsible for uninterrupted working. The speaker was personally thankful to the author for having mentioned that standard control of the settings had been reached, inasmuch as he (Mr. Settle) had devoted considerable time and attention to standardizing areas of air supplies, length of gas-nozzles, and obtaining the coned-injection of producer gas for flame lengths, all of which were now maintaining in every installation they had been applied to alike balanced working conditions and remarkable uniformity in temperature, not only in the whole of the range, but one setting with another. He thought Mr. Collett would bear him out when he said that No. 2 bench had worked since August, 1916, up to the present time, with practically no adjustments to the damper areas; and that, in the period named, uniform temperature had been maintained. Mr. Settle went on to say that the same conditions applied in a Midland city as at Leeds, with very little difference. As showing the flexibility of the adjustment of the heats, he said that 31° and 34° respectively were taken from the combustion chamber and placed at the top of the setting, with practically no difference to the temperature in the middle of the setting.

Mr. W. L. ROBERTSHAW (Sunderland) said at his works they had not had a stopped pipe in the last three years. It occurred to him that, if designers in the past had followed more on the lines of the first setting with separate take-off pipes to each retort, they would have got the gas regular, and Mr. Collett would never have had the troubles he had experienced. These troubles were no doubt due to the fact of bringing down the foul main near to the hydraulic, and making the up-take pipe so small. Regarding the flushing of the main with liquor, the speaker said he would like to know if Mr. Collett had had any experience of loss of ammonia. At Sunderland, previous to April, 1916, they worked the three eight-hour shift system; but he was allowed to try two eight-hour shifts; and they were worked from 2 a.m. to about 8 a.m., and from 2 p.m. until 8 p.m. This system went very satisfactorily. At first, they thought the quality of the gas would be affected, because of the six hours between the two last charges; but they found practically no difference. This great advantage was due to the interval between the two shifts; wherein they were enabled to carry out considerable repairs to the coke conveyors which could not be done under the three-shift system.

Mr. F. P. TARRATT (Darlington) spoke of flushing the mains with tar; and said at his works they flushed them three times a week with tar, and tar only. The scum was taken out at the scum-tank; and with this operation they had no difficulty. He thought flushing the tar-main with thin tar was likely to give better results than flushing with liquor, though Mr. Collett said he was getting good results with liquor. Tar was more of a solvent than liquor.

Mr. A. C. HOVEY (Sheffield) said the introduction of mechanical apparatus into hydraulic mains was certainly a bold thing to do. He thought the members would agree with him that agitators of any kind in gas-works were not desirable. [Laughter.] Mr. Collett seemed to have introduced between the retorts and the foul main what was practically a series of condensers and scrubbers. It was a question whether the retort-house was a proper place to carry out these operations. Nothing had been said with regard to producers. Perhaps this was outside Mr. Collett's sphere; but he (the speaker) might point out that, unless the producer was regular, the results would not be uniform. He would like to ask Mr. Collett what amount of ash he got in the coal he carbonized.

Mr. COLLETT, in replying to the discussion, said he believed that at East Hull they worked at rather lower temperatures than at Leeds, because of the different classes of coal; and this, he thought, largely accounted for the difference in the temperatures. As to the two *versus* three eight-hour shifts, they had had no difficulty. They went on the three eight-hour shifts simply because they had to make arrangements when they put up the second bench, in order to work the rounds in and allocate the work among the men more easily. It was after this that they found out the benefits which accrued on the first bench. Now that they had modified the second bench, and had obtained better results and lower temperatures, and had got rid of their troubles, he did not think that they would have any difficulty if they went back to the two eight-hour shifts on the second bench. but it would serve their purpose better at present to keep to the three shifts. With regard to pressure in the foul main, Mr. Nelson said he wondered what pressure there was on the bottom of the retorts. There was no additional pressure. The pressure on the foul main was due to its elevation. They had no pitch-pans in the hydraulic mains. The mains were cleaned out once a week. Any sediment was removed, and the rest flushed away down the tar-mains. All solid matter was collected into the intercepting tank. The gland on the top of the main required packing occasionally. They had had no alteration of the dampers; these had kept wonderfully regular. They had got on to standard conditions in regard to the heating of the dampers. Respecting the liquor circulation in the hydraulic mains, and any loss of ammonia that had been mentioned, he said with their system they had got rid of any loss of ammonia. They secured very regular supplies of gas from the producer, though they used many different kinds of coal. There was the step-grate kind of furnace; and the men got into the working of these very well. The coal they generally carbonized was second-class Yorkshire; and the ash ranged from 9 to 12 p.ct. The gas was very regular. It would not assist them to get any further monotonous regularity of working. It would improve working results to obtain every ounce out of the coal.

Records of Services.

Writing in the American "Gas Institute News," Mr. H. B. Andersen remarks that, under certain conditions, service records are equally as important as mains records, although generally speaking they are not nearly so frequently used for reference. This is because there is seldom any visible indication as to the location of a main; whereas the house-end of a service is always visible, and usually the stop-box (if there is one). Therefore, if the service is laid without bends, and at right angles to the kerb or building line, there will be little trouble in locating it for any of the purposes which are most common. In addition to furnishing knowledge of the location of a service-pipe preparatory to digging, a service record is of use in obtaining data about the age of the service, and in giving the office proper knowledge when a new meter, &c., order is received. It has been found that a card 3 in. by 5 in., suitable for vertical filing, is very satisfactory for the purpose of a service record. The card is filed geographically; the street number being on the top line. Below this, the following information is then filled-in: Name; nature of building; nature of work done; particulars of stop-cock (if any); size, location, and depth of the main to which the service is connected; name of workman; date of installation. The card starts in the office as an order for the workman to do the job; and he fills in all the data required as he completes the work. Mr. Andersen, however, points out that, while this system shows the age of each service, it does not provide a record which will show quickly at any time all the services of a certain age. While the value of such a record at present is problematical, it is not unreasonable to assume that at some period in the future a large number of steel and wrought-iron services will reach a critical stage as regards their ability to withstand the strains incident to the freezing ground. Under conditions like these, such a record would be invaluable, because by its help special precautions could be taken to discover at once, and so minimize the effect of, any leaks that might occur. The form of the record would be a chronological list of services as laid. On the same sheet can be entered the length of service laid; and the addition of these lengths for any given period will give the figure used in computiug unit costs for this period.

Calorific Standard Application and Order.—The Board of Trade have received an application from the Farnham Gas and Electricity Company for the sanction of a calorific power standard of 500 B.Th.U. They have made an Order under the same Act for the Redhill Gas Company.

THE TESTING OF REFRACTORY MATERIALS.

By Dr. J. W. Mellor.

One of the papers read at a meeting of the Refractory Materials Section of the Ceramic Society, held in the Royal Technical College, Glasgow, on Tuesday and Wednesday of last week, was by Dr. J. W. Mellor (the Hon. General Secretary), on the "Testing of Refractory Materials," in the course of which he described some thoughts which have grown from a study of refractories under load.

Dr. Mellor began by emphasizing the importance of standardizing the methods of conducting tests, since a consignment might be condemned on a set of tests conducted in one laboratory which would pass the tests satisfactorily if conducted in another laboratory. He believes that the standardization of the methods of testing refractories is one of the first duties which should be undertaken by a Society, who can afterwards deal with specifications for refractories. The fire stability of a refractory is, perhaps, its most important quality; and one of the most important properties indicating the fire stability of a refractory is the squatting temperature. It is very important that we have a clear idea what is meant by what is variously called the fusing temperature, softening temperature, squatting temperature, fire stability, and the melting or fusion point of a refractory. I went, proceeded the author, into this question some years ago, and have very little to add to what was then developed. These results have been confirmed by work in other countries—Germany, America, etc.

1.—The Importance of Specifying the Rate of Rise of Temperature.

When the temperature of a fire-clay or fire-brick is gradually raised, the material—more particularly aluminous fire-bricks—behaves in a manner almost analogous with pitch or butter. The material becomes less and less viscous. Ultimately the viscosity is so reduced that the material is no longer able to retain its shape, the angular corners and edges are rounded, and the material begins to flow. There is no precise or definite temperature above which it can be said that the material is a flowing liquid, and below which it is a rigid solid. The softening temperature of a fire-brick is not therefore a definite temperature, but rather a range of temperature within which the substance begins to lose its shape, and commences to flow. Observation shows that this range of temperature is wider with aluminous fire-bricks than it is with siliceous fire-bricks.

If the temperature be rapidly raised, the material appears to soften at a higher temperature than if slowly heated, because the internal forces have not time to attain a state of equilibrium before the material is carried to a still higher temperature. Otherwise expressed, the actual squatting of the material lags behind the temperature; and the faster the rise of temperature, the greater is the lag. The effect is sometimes very pronounced. For instance, two different fire-bricks with a variation of 150° in their squatting temperature on a slowly rising temperature, appear to be equally refractory on a rapidly rising temperature. The softening temperature of a refractory for one rate of rise of temperature does not correspond with the softening temperature determined for another rate of rise of temperature. Consequently, the rate of rise of temperature must be standardized, if refractory tests are to be compared one with another. Although this has been clearly defined in the Institution of Gas Engineers' Standard Specification for Refractory Materials, the importance of the fact does not appear to have been grasped by all.

It has been stated that the softening temperature of a substance is a range of temperature within which the material begins to lose its shape. This range of temperature is conveniently referred to Seger cones, which are standard mixtures of silicate materials designed to soften within certain ranges of temperature. The softening temperature is determined by heating a selected piece of the refractory material—approximately shaped like a cone or prism, 1½ in. high and ½ in. to ¾ in. base—alongside a suitable number of Seger cones covering a certain range of temperature. When the test-piece shows signs of fusion, it is assumed that the softening temperature is best represented in terms of the cone which squatted nearest to that at which the clay begins to fuse. At first sight, this seems rather a primitive method of conducting the test; but, all things considered, and with all the refinements of modern science at our disposal, I do not know a better way.

2.—Definite Temperatures versus Seger Cones.

Is it better to express the softening of a refractory as a definite temperature determined by means of a pyrometer or in terms of suitable cones? So far as I can see, in the present state of our knowledge, the answer must be given in favour of cones. It must be remembered that we are dealing with a range of temperature, not a specific temperature. Whatever be the nature of the reactions which are attended by the fusion of the refractory, it is assumed that the temperature coefficient of the reaction in the Seger cone and clay are the same. This assumption is based on more or less remote analogy between the cone and the clay. I must confess that when I am told a fire-brick has "a melting-point of 1700° C.," I can attach no clear meaning to the phrase. A lot of other information is required; and we can confidently anticipate that if others had made the test, a different result would be obtained. A seller would naturally desire to have his tests made at the laboratory which gives the highest result, and a buyer at the laboratory which gives the lowest result. I believe that the representation of the softening temperature of a clay in terms of a definite temperature gives an appearance of accuracy to the results which is quite illusory.

3.—The Size of the Test-Piece.

Would the refractory test be improved by using larger pieces—say, a whole brick? I do not think so. There are difficulties, but not insuperable ones, in maintaining a whole brick at a uniform temperature throughout the mass, and also in estimating the temperature of the interior of a hot brick. Unless I am mistaken, the fusion of a brick always commences at the surface, not necessarily because on a rising temperature the surface must be slightly hotter than the interior, since by raising the temperature slowly enough the difference of temperature could be made negligibly small. If arguments I gave in 1909 are correct, the phenomenon is an effect of surface tension, and the surface of a fire-brick of uniform composition uniformly heated must be the first to show signs of fusion. So far as my observations go, I have not found any difference in the fusion test, whether the surface examined be large or small, provided the radius of curvature is large and the rise of temperature be not too rapid. True, with abnormally fine powders, where the radius of curvature is small, there is a marked difference, but not under ordinary conditions.

4.—Oxidizing versus Reducing Atmospheres.

It is well known that if a refractory material contains much iron, its refractory test gives a lower result if conducted in a reducing atmosphere than if conducted in an oxidizing atmosphere. Bricks are usually fired in an oxidizing atmosphere, and very frequently used in a reducing atmosphere. The test naturally should be conducted under reducing conditions; and it is perhaps easier to make the test under such conditions than in an oxidizing or neutral atmosphere. The only objection to the reducing atmosphere depends on the fact that the reduction of the iron sometimes takes a long time, and it is then difficult to get constant and comparable results. A different proportion of the iron is reduced in the different cases. This question is being treated by the Gas Engineers' Committee on Refractory Materials; and something definite may be expected in their next report.

5.—Testing Refractories under Load.

There is a difficulty in standardizing the test for refractories under load. The results are curious and particularly interesting. With the more aluminous types of refractory, there is a rapid fall in the squatting temperature as the load increases. To get comparable results from test to test, for industrial purposes, it is necessary either to fix an arbitrary pressure at which the tests shall be made, or else to express the results in the form of a curve. The latter is perhaps the better way, although it will probably be more convenient to conventionally specify a definite load—say, 30 to 50 lbs. per sq. in. With aluminous refractories, there does not appear to be a limit to the decrease in the refractoriness under an increasing load. Indeed, there is every reason to suppose that aluminous bricks could be vitrified by pressure alone; and Spring's experiments in 1884 showed that purified alumina, normally stated to melt at about 2000°, can be melted at ordinary temperatures by a pressure of about 5000 atmospheres per sq. cm. But neither natural nor artificial silica showed any evidence of fusion. Tresca also, in 1868, obtained evidence that dry clay flows like a liquid by the application of a pressure of 10,000 kilos. per sq. cm.

6.—Manufacture of Fire-Bricks without Kiln-Firing.

The logical inference from these facts is somewhat startling. It is merely necessary to drive the water from clays, and then mould the bricks under a great enough pressure to perform the work of vitrification without any firing of the bricks at all. I have taken some trouble in the past to emphasize the fact that the vitrification changes which occur during firing are arrested by the manufacturer at a certain stage of their progress, and that a number of firings at (say) Cone 4, under normal conditions, will do the work effected by one firing at Cone 10. When no undue pressure is exerted, however, the reaction is arrested if the temperature be reduced very much below Cone 4, and no vitrification occurs. At first sight, any proposal to manufacture good fire-bricks without kiln-firing seems to border on madness. We have become so obsessed with the idea that manufacturers of fire-bricks do not fire their products to a high enough temperature that a counter proposal, (say) to compress the dehydrated clays in a freezing chamber without firing, appears the rankest heresy, not to be taken seriously. In spite of this, I see no flaw in the deduction when applied to aluminous clays. In practice, however, things have a way of developing differently from what logic prescribes, because we are so liable to overlook essential

factors. In the present case, the unforeseen difficulties will have to be furnished by observation and experiment.

I should very much like to see the experiment performed. But it would not be the first application of the idea; since I am told that over 45 years ago, Mr. W. H. Turner, of Staffordshire, made vitreous pottery, and actually attempted its manufacture on a commercial scale, by the application of enormous pressures, and without firing. Nothing appears to have developed from the idea; but I believe that in the light of what we have learned to-day he was a bit in advance of his time. If the necessary funds were available, I should certainly try the experiment. The provisional assumption is made that the product formed by the vitrification of the clay will be satisfactory, whether the vitrification be performed at a high or at a low temperature.

We can, however, easily be lost in a labyrinth of unprofitable speculation as to what might happen. An experimental trial can alone give the empirical data required for further progress in this direction. I believe the deduction I have outlined justifies the expenditure of a few thousands. Possibly the right way to get the idea tried practically would be to place evidence before a professional promoter of new schemes, and give him the first option on any resulting patents. In spite of the well-known admonition—Do not prophesy unless you know—I will be reckless enough to predict that the result would be successful with the aluminous types of fire-clay, though I do not think it would be successful in making silica bricks without a rather more elaborate preliminary treatment of the raw material than would be needed with normal fire-clays. Even here, however, I believe the cost of the preliminary treatment would still keep the total cost of manufacture less than is involved in the present method of manufacture.

7.—Some Theoretical Considerations.

There is an important theoretical question. The results obtained by testing refractory materials under a load appear to contradict the well-known thermo-dynamic formula:

$$\frac{dT}{dP} = \frac{T}{L}(v - v_0)$$

where P denotes the pressure, T the absolute temperature of fusion, v the volume after fusion, v_0 the volume before fusion. This formula has been verified and established by experiment. The main assumption behind this rule is the impossibility of perpetual motion. We should be justified in suspecting any conclusion which is not in accord with this rule. If the latent heat of fusion is positive, as it always is, then the raising or lowering of the fusion temperature with unit change of pressure (dT/dP) is dependent on whether the volume v of the liquid is greater or less than the volume v of the solid. If the volume of the material decreases during fusion, so that $v < v_0$ the melting temperature will be lowered by pressure, and if the volume increases during fusion so that $v > v_0$, the melting temperature will be raised by pressure. Otherwise expressed, an increase of pressure favours the state which has the smaller volume. Ice at 0° has a larger specific volume than water at the same temperature. Consequently an increased pressure favours the water phase, and the ice melts.

The volume of most of the silicates involved in the vitrification of a brick in burning increases during fusion. For instance, the specific gravity of a sample of fire-clay was 2·627 before fusion, and after fusion 2·470. This corresponds with an expansion of about 6 p.ct. In this respect, therefore, clay behaves like numerous other silicates. Consequently, an increase of pressure should raise, not lower, the fusion temperature of the clay. It has been assumed that the latent heat of fusion L is constant. Experiment shows that this assumption is generally valid, although Tammann and others have discussed the possibility of the latent heat of fusion changing from a positive to a negative value. Also Tammann has shown that, since a liquid is usually more compressible than a solid, a positive value of $v - v_0$ diminishes with an increase of pressure, and, after passing through zero, will gradually assume an increasing negative value.

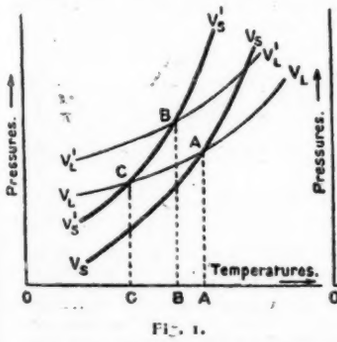


Fig. 1.

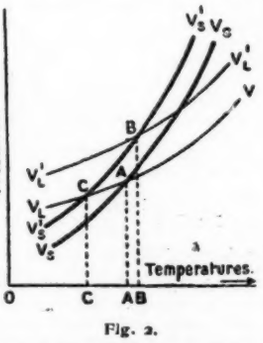


Fig. 2.

I do not think that the discrepancy between theory and practice is to be attributed to either of these possibilities; rather is the formula not applicable to the case under discussion. Theory assumes that the pressure is uniformly exerted in all directions; whereas the interstices between the grains of a fire-brick would give the pressure the character of a shearing stress. The solid and liquid phases do not therefore suffer the same increase of pressure. Roozeboom has shown that if V_S and V_L (figs. 1 and 2) represent the vapour pressure curves of the solid and liquid states at a pressure P, and V'_S and V'_L represent the vapour pressure curves of the solid and liquid at a higher pressure, when the two phases—the liquid and solid—are subjected to like pressure, the point of intersection A of the V_S and V_L curves will represent the melting-point of the substance under a pressure. Similarly the point of intersection B of the curves V'_S and V'_L will represent the melting-point of the substance under a pressure higher than P. When the solid phase alone is subjected to the increased pressure, it will melt at the point of intersection C of V_L and V'_S curves. The temperature OC is always less than OA, whether OB be greater or less than OA. Consequently, the melting-point of a solid will always be lowered when the pressure acts on the solid, but not on the liquid. Rieke calculates that by the application of a pressure P,

$$\text{Lowering of melting point} = \frac{vT}{2LE}P^2$$

where E represents the elasticity of the solid in the direction of the applied pressure P; L, the latent heat of fusion; T, the absolute melting-point; and v the specific volume of the solid.

REFRACTORY MATERIALS SECTION OF THE CERAMIC SOCIETY.

On Tuesday and Wednesday last, the Refractory Materials Section of the Ceramic Society held their first meeting of the season, at the Royal Technical College, Glasgow—the chair being occupied by the President (Mr. W. J. Jones, of the Ministry of Munitions), who addressed a few opening remarks to a numerous gathering of members from widely separated parts of the kingdom.

The first paper was by Mr. L. W. Hinxman, B.A., F.R.S.E., and Mr. M. Macgregor, M.A., B.Sc., on

The Distribution and Geological Position of the Valuable Fire-Clays and Ganisters of the South of Scotland.

Perhaps the most striking point about these is the fact that they occur chiefly in association with the millstone grit, unlike the corresponding refractories of England and Wales, which mostly occur in the coal measures. The millstone grit series was accordingly described in some detail; short notices of the coal measure fire-clays, carboniferous limestone series, and calciferous sandstone series being added.

Then followed a paper by Mr. J. G. Maxwell (of the Gas-Fired Kiln Company, London) on

Refractories and Modern Kilns.

It was pointed out that, under existing conditions, town gas and oil are too expensive as fuel for kilns. Peat and lignite must first be gasified. It is claimed that producer gas has the following advantages over coal—viz.: (1) Complete control of the temperature; (2) greater economy and speed in producing high temperatures, and more ready maintenance of a given temperature; (3) great cleanliness of burning; and (4) great saving of wear and tear. It should be realized that proper distribution of the gas is now thoroughly understood, and uniform distribution of heat in the kiln can be obtained.

The three best-known types of kilns for refractory goods are: (1) The continuous annular shape gas-fired kiln; (2) the continuous annular shape chamber type gas-fired kiln; and (3) the continuous tunnel and car kiln. Each type can be fired with coal instead of gas. These types of kilns were briefly described, with the arrangements of gas flues, dampers, air supply, &c.; and their efficiency was discussed. In the author's opinion, for most kinds of high-class refractory ware, the kiln of the future is the continuous tunnel and car kiln. It was explained that this kiln can be slackened-down for week-ends, &c., without the slightest detriment to the quality of the ware—it merely means an appropriate reduction of the gas supply, and moving the cars round at long intervals.

The next paper was by Mr. H. Le Chatelier and Mr. B. Bogitch, on

The Refractory Properties of Silica.

The difference between clay bricks and silica bricks when heated was pointed out. The former begin to soften between 1300° and 1400°, and when further heated act like a vitreous substance. The assumed fusion point of pure kaolinite (1780°) corresponds in reality to the rapid giving way of the substance under a load equal to the weight of the test piece. Under a load 1000 times greater the same result is obtained with the same rapidity 400° lower. There is no definite fusing point, but rather an extensive fusibility range. On the other hand, quartz apparently has a real fusing point without previous softening, and accordingly independent of pressure. This was clearly shown by the difference in behaviour of small cylinders of clay and silica when strongly heated under pressure. It was deduced from the results of experiments on good silica bricks of American make that the resistance of bricks in the arches of steel furnaces is about ten times what they have actually to withstand. This mechanical resistance at very high temperatures is a special peculiarity of

silica bricks. Even bricks whose essential constituent is magnesia—itself much less fusible than silica—do not offer this resistance. The difference is attributed to the influence of impurities (alumina, lime, oxide of iron, alkalies, &c.), which in all cases give rise to material fusible at about 1200°. The solid grains of magnesia float in the melted magma and slide over one another easily like wet sand. Silica in well-fired bricks forms a continuous network, and the melted substance lodges in the pores without materially reducing the mechanical resistance.

Le Chatelier himself, in a recent paper, proved that the formation of this network is due to differences in solubility of the varieties of silica. The quartz dissolves in the melted magma, and then recrystallizes—first as cristobalite and then as tridymite. Underfired bricks are composed of grains of quartz, floating in the melted material, and when hot they are plastic like magnesia bricks or clay bricks. The decreasing resistance of good silica bricks with rise of temperature is caused by the increasing solubility of the silica which forms the network; and it is important to note that the quality of silica bricks depends mainly on the development of the network. The chief factors to be considered are: (1) The proportion of fluxes, (2) the temperature of the brick, (3) the proper formation of the network, and (4) the disintegration of the network through subsequent swelling out.

Good silica bricks are found to contain between 3 and 5 p.ct. of basic oxides, and such bricks can withstand a temperature of 1700° in steel furnaces. For coke-ovens, where a lower temperature prevails, at least double the amount of basic oxides just mentioned can be used without any ill-effect, thus greatly facilitating the manufacture. For proper development of the network, the bricks must be maintained during several days at a temperature of nearly 1450° (but must be kept below the temperature at which the quartz is directly and rapidly changed into cristobalite). Solution and rapid recrystallization to form the network is aided by the fineness of the grain of the quartz used. But a certain proportion of large grains is necessary in order to avoid the development of cracks.

When a brick containing unchanged grains of quarts is afterwards heated quickly to a temperature at which quartz is rapidly transformed, the expansion which accompanies the transformation shatters the network and robs the brick of all solidity. The resistance to its lateral expansion in the arch results in spalling; and thus the falling of small fragments sometimes causes in a few days the destruction of an arch which should have lasted months. The same expansion occurs during normal firing of the bricks; but the expansion of the brick can then develop freely in all directions, and there is opportunity for the network to be formed again where it has been cracked.

The authors conclude from the results of their experiments that, after heating for an hour at 1600°, all good silica bricks offer a resistance to crushing equal to at least 10 kilos. per sq. cm., and prolonged heating at the same temperature decreases their resistance only slightly as compared with bad bricks.

In the course of a discussion on Mr. Maxwell's paper, Major C. W. Thomas (Stourbridge) pointed out that the greater cost of town gas was largely compensated by certain special advantages. Mr. Bernard Moore (Stoke-on-Trent) went even further—expressing the opinion that town gas would be the fuel of the future for firing. He had used with great success a small gas-fired kiln in the Research Department of the Pottery School at Stoke, and found the heat well distributed.

The papers by M. Le Chatelier and Mr. Bogitch and Dr. Mellor [see p. 76] also gave rise to interesting discussions.

Three short papers were communicated—"A Comparison of the Porosity and Contraction of Fire-Bricks made with Wet and Dry Grog," by Miss C. Beveridge and Mr. W. Emery; "The Rate of Reaction (Vitrification) of Different Forms of Silica," by Mr. P. S. Devereux and Mr. J. E. Foster; and "The Rate of Hydration of Calcined Dolomite," by Messrs. Edwards and Rigby.

The members dined together in the evening. The President, responding to the toast of "The Ceramic Society," laid stress on the advantages of co-operation between makers and users, aided by scientific experts, and on the benefits resulting from better relations between employers and workmen. He also paid a very handsome tribute to Dr. Mellor's unremitting and very successful efforts for the good of the Society.

Arsenic in Coke.—Recent tests at the Breslau Technical High School gave the following percentages, estimating by the Arch-butt-Jackson method, for the arsenic content in various samples of coke: (1) Westphalia coke, 0·011; (2) Rhineland coke, 0·002; (3) coke from the Saar district, 0·0052; and (4) American beehive coke, 0·0037.

Position of the Chemical Trades after the War.—The Minister of Reconstruction has appointed a Committee, with Sir Keith W. Price as Chairman, to advise him as to the procedure which should be adopted for dealing with the position of the chemical trades after the war. Among the members are Mr. Charles Carpenter, D.Sc., M.Inst.C.E., Mr. J. F. Brunner, M.P., and Sir William Pearce, M.P. The Committee will conduct their deliberations with a view to the creation of some organization which should be adequately representative of the chemical trade as a whole, and by means of which the trade may be enabled hereafter to continue to develop its own resources and to enlist the closest co-operation of all those engaged in the chemical industry.

THE PRODUCTION AND PREVENTION OF NAPHTHALENE.

Last week [pp. 27 and 28], we gave the conclusions arrived at on this subject by Mr. Thomas D. Miller, as communicated to the September issue of the "American Gas Institute News"—founded on a series of replies to questions addressed to members of the Institute, who were referred to by letter and not by name. We were only able to overtake the portion of the appendix to Mr. Miller's paper referring to works A to J. To-day we complete the reprint by dealing with works K to S.

K—In Woodall-Duckham continuous vertical retorts, we positively do not show any signs of naphthalene at any time. I do not know whether this is due to the low production of naphthalene or to its high solubility in vertical-retort tar. I am inclined to think that it is largely due to the comparatively low temperatures under which the gas is made. Our retorts are 25 ft. high; and the temperature ranges from 1300° Fahr. at the bottom to 2300° Fahr. at the top. These temperatures are outside the retort.

L—The statement that has been repeatedly made, to the effect that no naphthalene troubles are experienced with gas made in vertical retorts, is absolutely correct. I know of no plant operating in this country, carbonizing coal in vertical retorts, either of the continuous or intermittent type, which has ever experienced naphthalene troubles.

M—Analyses of the gas will show the presence of naphthalene, but, of course, in very much reduced quantities. The gas, however, seems to have the capacity to carry what naphthalene is present to the burner, as stoppages are practically unknown with vertical gas.

N—Our retort-house consists of 3 million c.ft. per day of Dessau verticals. We have had no trouble at any time from naphthalene, and have, therefore, paid very little attention to it. Some little time ago, as a matter of curiosity, I had tests made, resulting as follows:

Outlet of primary condenser	9·9	grains per 100 c.ft.
Outlet of Pelouze and Audouin condenser	7·5	,, ,,
Outlet of secondary condenser	7·0	,, ,,
Outlet of washers	3·5	,, ,,
Commercial gas	3·2	,, ,,

The repeated statement that no troubles are experienced where verticals are used, I should say was absolutely correct, judging from the experience we have had here.

O—Prof. Berthelot, of Paris, says: A hydrocarbon does not dissolve in its elements, but is transformed into multiples of more condensed hydrocarbons, eliminating hydrogen (polymerization). One of his experiments consisted in heating methane, when he obtained acetylene, olefines, naphthalene, and tar.

Prof. V. B. Lewes wrote: In practice, the hydrocarbons to a great extent leave the coal as vapours of condensible hydrocarbons; and the breaking-down of these to such simple gaseous compounds as ethylene is proceeding at the same time as the breaking-up of the ethylene, already formed, into acetylene and methane, and the polymerization of the former into higher compounds. Bodies like naphthalene and anthracene have such great stability that when once formed they resist any effort to again decompose them by heat.

Some pyrogenic reactions quoted from various authorities are as follows:

1—5 $C_2H_4 = C_{10}H_8 + 6H_2$.
2—2 $CH_4 = C_2H_2 + 3H_2$: $3C_2H_2 = C_6H_6$: $2C_6H_6 = C_{10}H_8 + C_2 + 2H_2$.
3—2 $C_6H_6 = C_{12}H_{10}$ (Diphenyl) $+ H_2$: $C_{12}H_{10} + C_2H_4 = C_{14}H_{10} + 2H_2$.
4—3 $C_6H_6 = C_{14}H_{10} + 2C_2 + 4H_2$.
5—$C_6H_6 + C_2H_4 = C_6H_5C_2H_3 + H_2$: $C_6H_5C_2H_3 + C_2H_4 = C_{10}H_8 + 2H_2$.

P—Naphthalene is formed from the gas, and not from the coal direct; and I also believe that a large part of it is formed from the benzene series of hydrocarbons. Under the effect of heat, all compounds containing carbon and hydrogen tend to form naphthalene; but it seems that the higher the percentage of carbon in the compound, the greater its tendency to form naphthalene.

Our experience with the 16-ft. retorts at "A" and "B" shows that a large gas-space in the retort means more naphthalene, and a comparison of the 20-ft. retorts at "A," with the 16-ft. retorts at "B" also shows that the time of contact has much to do with the formation of naphthalene.

We have no analyses of the illuminants in coal gas; but our B.Th.U. and candle-power tests indicate very clearly that higher and longer heating of the gas means a loss of the heavier vapours, such as benzene.

The order of decomposition in making coal gas hydrocarbons seems to be as follows:

COAL.

Paraffins — Olefines — Olefines — Aromatics (Benzene) — Hydrogen

Paraffins — Olefines — Aromatics — Hydrogen — Naphthalene — Carbon

The decomposition is continuous; and both time and temperature have their effects. But I believe that there is a point at which a good yield of good quality gas, containing little naphthalene, is made. The problem is how to remove it at the moment it is formed.

I have no data at hand on continuous vertical or inclined retorts; but I would expect them to come nearer to the ideal than any other construction.

Q—Much, of course, has been written upon the naphthalene question; but, as is too frequently the case with various problems, the underlying fundamentals essentially affecting the observed results, &c., are seldom studied sufficiently.

Troublesome conditions or effects are observed in connection with naphthalene; but in our usual attempts to find out the causes we

frequently neglect to consider basic conditions, and instead jump to hasty conclusions founded only upon some minor variables, or conditions which are only indirect causes, or are even sometimes not essentially involved in the question.

The naphthalene problem to me resolves itself into the following subdivisions or lines of thought:

1. What are the materials from which naphthalene may be formed?
2. What are the fundamental conditions under which naphthalene is formed?
3. What are the fundamental conditions affecting the removal of naphthalene after it has been formed?

Obviously the third line of thought is not necessary if a thorough study of the second question reveals the possibility of practically controlling the fundamental conditions so that naphthalene is not formed. However, it is highly doubtful if we shall ever be able to entirely disregard the means of removal or absorption of naphthalene at the works or elsewhere.

Regarding the first question, it appears fairly well established that coal and gas oil—two very essential raw materials from which ordinary so-called illuminating gas is made—each contains constituents or compounds of carbon and hydrogen which, under certain conditions, are capable of forming naphthalene. Therefore we cannot expect a solution of the naphthalene problem primarily from a study of the raw materials (advisable as such an investigation would be), because, while it may be true that some yield under a given condition more naphthalene than others, yet it is fairly certain that all are direct contributors of the elements entering into its composition depending greatly upon the fundamental conditions under which naphthalene is formed.

The second question is, without doubt, the most important from many standpoints and particularly from that of the possible prevention of its formation in detrimental quantities.

The formation of naphthalene is subject to the same general factors or conditions which fundamentally affect practically all the physico-chemical changes in organic substances accompanied by the absorption or evolution of heat. Some of the more important of these factors may be listed as (1) temperature, (2) time, (3) concentration. Temperature has an important effect, as it is common knowledge that physico-chemical decomposition or actions proceed with greater rapidity as the temperature rises—other factors being more or less constant. Time is also of great importance, because upon the "time of contact" of the matters with the hot surfaces depends the amount of physico-chemical change that takes place. Concentration is also worthy of consideration, as it affects to some extent the rapidity of the action.

It is obvious, therefore, that naphthalene formation is dependent to a considerable extent upon the temperatures of the coal or gas-oil and of the vapours evolved from them; upon the time that the vapours are subject to these higher temperatures; and upon the concentration of the vapours while at these higher temperatures. Hence, the construction of the retort, oven, or gas machine, the temperatures of the walls or chequer brick, the free space for the travel of the vapours resulting from the decomposition of the raw materials (coal and gas-oil), in fact all features of construction and operation affecting the temperature, time, or concentration, are involved in naphthalene formation.

Another phase of the subject is the study of the stages of decomposition or the steps in the formation of naphthalene. It is a well-established fact that whenever compounds of carbon and hydrogen—such as we find in coal or gas-oil—are heated, the tendency is towards the more or less gradual transformation of these compounds into carbon and hydrogen, the constituent elements combined in the compounds. In other words, the tendency, in the continued decomposition by heat of the volatile matters from coal and of the oil vapours from the gas-oil, is to gradually form compounds approaching greater stability and 100 p.ct. of carbon in composition with the evolution of gases also approaching greater stability and 100 p.ct. of hydrogen as to their composition.

For example, experimental and theoretical considerations and data seem to show that the decomposition of a heavy paraffin hydrocarbon in gas-oil, while resulting in a great many compounds of various chemical series, probably follows the trend as shown below:

Table of Typical Condensable Compounds Illustrating Various States in the Progressive Decomposition by Heat of the Paraffin Hexadecene.

Compound.			Percentage of Constituents.	
Name.	Chemical Series.	Chemical Formula.	Carbon.	Hydrogen.
Hexadecene	Paraffin . . .	$C_{16}H_{34}$ ..	84·9	15·1
Duodecalene	Olefin	$C_{12}H_{26}$ ..	85·6	14·4
Cymene	Benzene . . .	$C_{10}H_{14}$ ..	88·1	11·9
Xylene	Benzene . . .	C_8H_{10} ..	90·5	9·5
Toluene	Benzene . . .	C_7H_8 ..	91·3	8·7
Benzene	Benzene . . .	C_6H_6 ..	92·3	7·7
Naphthalene	Naphthalene . .	$C_{10}H_8$ ..	93·7	6·3
Anthracene	Anthracene . .	$C_{14}H_{10}$ ..	94·3	5·7
Carbon		C_x ..	100·0	

The table does not, of course, illustrate the hundreds of various decompositions and changes taking place, but is intended only to represent the general character of the progressive decompositions or actions resulting in the formation of various typical compounds which condense and are found in the tars or elsewhere in a coal-gas or carburetted water-gas system.

The underlying feature of the decomposition, due to continued heating, seems to be the tendency of more complex compounds in a given chemical series, such as the paraffines (C_nH_{2n+2}), the olefines (C_nH_{2n}), and others, to break-up into simpler compounds of the same and other series, and to form more complex condensable compounds richer in carbon or gases more concentrated in hydrogen.

It should be realized that perhaps hundreds of changes are continually taking place, tending to break-down the more complex compounds of a given series to simpler and more gaseous ones in the same series, and at the same time to form many other more condensable compounds richer in carbon, and more fixed gases richer in hydrogen. For example, ten volumes of the gas ethane (C_2H_6) of the paraffin series, when heated for one minute at 1000° C., have been found to decompose about as follows to:

12 volumes Methane	CH_4	(a more simple paraffin)
3 volumes Ethylene	C_2H_4	(containing 85·6 p.ct. carbon)
1 volume Acetylene	C_2H_2	(containing 92·3 p.ct. carbon)
20 volumes Hydrogen	H_2	(containing 100 p.ct. hydrogen)

Further and continued heating decomposes the methane (CH_4), ethylene (C_2H_4), acetylene (C_2H_2), and other products into the end products of carbon C and hydrogen H_2.

It is, therefore, fairly clear that no matter whether the naphthalene is formed from other simpler products of decomposition or from a complex compound containing originally more hydrogen, naphthalene is probably only one of many compounds which are but steps or stages in the decomposition of hydrocarbons by heat to the final elementary forms of carbon and hydrogen.

Investigation may show that the very agent which is a direct factor in its formation may be the possible means by which naphthalene can be decomposed or eliminated. In other words, longer exposure to heat or else higher temperature may result, under certain conditions, in further decomposition of naphthalene to compounds more concentrated in carbon or hydrogen which are more easily disposed of than naphthalene.

The main point I wish to make is that a thorough study of the question, "What are the fundamental conditions under which naphthalene is formed?" gives, in light of our present knowledge of the general tendency of the decomposition of coal or gas-oil by heat, the greatest promise of success in solving the so-called "naphthalene problem" of the gas industry.

Personally, I am of the belief that a thorough study of the effects of temperature, time of contact of the decomposing matters with the hot surfaces such as retort walls, chequer-brick, &c., and other fundamental factors must be thoroughly studied, probably in a small test plant or apparatus where all the variable factors can be observed accurately, and reasonably controlled or varied at will, for the purpose of ascertaining the general tendencies or laws governing the forming of naphthalene.

The last question—namely, "What are the fundamental conditions affecting the removal of naphthalene after it has been formed?"—is one which has probably been given the most study. However, it might be investigated further with profit if a thorough investigation of the second question reveals the fact that we cannot expect to entirely eliminate naphthalene by more scientific construction and control of our retorts, ovens, and gas machines which carbonize or "crack" coal or gas-oil.

This letter is not so much an attempt to answer the questions as an endeavour on my part to lay before you my ideas regarding the most promising field of research open to the gas industry if it really wishes to go deeply into the matter of solving the naphthalene difficulties.

R—As regards naphthalene, would advise as follows: In my opinion the production of naphthalene during the carbonization of coal is undoubtedly due to the condensation or polymerization of paraffin hydrocarbons, particularly those of the olefine or ethylene series of the general formula C_nH_{2n}.

The synthesis of naphthalene (which is an aromatic hydrocarbon) from a paraffin hydrocarbon, has been accomplished in laboratory investigation, and the similar synthesis of benzene and toluene by the Rittman process seems to give further proof of such changes in constitution.

The fact that naphthalene is produced in varying amounts in both carburetted water gas and in oil gas, dependent upon operating conditions, tends to substantiate its paraffin origin.

Naphthalene formation is influenced by the kind of coal used, the type of carbonizing chamber employed, and the degree of superheat to which the gas is subjected on exiting from the charge. In the older types of benches—viz., horizontal and inclined retorts—the gas is in contact with a considerable heated surface; and while the production of naphthalene may be reduced by working with heavy charges, its total elimination is impossible.

With the vertical retort systems, particularly those of the continuous type, this superheating effect is to a very great extent eliminated, since the gas passes through the core of uncarbonized coal and little or no naphthalene is produced. The tar produced in these retorts is distinctive, as it contains paraffin bodies significant particularly with the absence of naphthalene in the gas.

I have no record of the varying constitution of the gas in connection with high or low naphthalene contents, and feel that such records would only be comparative and not absolute. In the same plant, any change in the operation of the retort-house would naturally affect the quality of the gas; and I fear it is doubtful if adequate comparison on the basis of gas quality could be made between the gas from several retort systems in determining the amount of naphthalene that should be present.

Coal gas has a definite saturation for naphthalene—in other words, at a certain temperature it can carry a certain quantity of this impurity. Consequently if naphthalene is produced in the retort-house it will always be found in the gas.

The greater portion of the naphthalene produced, especially with high distillation or carbonization temperatures, goes over into the tar, the gas containing only a portion of the naphthalene vapour; its maximum content being dependent upon saturation of various temperatures. But outside the temperature of carbonization, the amount of naphthalene present in the gas is also due to the character of the coal used, and upon the time of contact between the gas and the hot coke and hot retort walls.

NAPHTHALENE SATURATION.

Temperature.		Grains per 100 C.Ft. of Gas.	
Centigrade.	Fahrenheit	Schlumberger	Allen
0°	32°	2·0	6·0
5	41	3·2	9·8
10	50	6·7	14·1
15	59	10·9	19·0
20	68	16·5	24·6
25	77	24·7	30·9

For higher temperatures than those given in the table, the amount of naphthalene in saturated gas averages per 100 c.ft. at

90° Fahr.—	71·00 grains	100° Fahr.—	116·97 grains
110° ,, —	182·10 ,,	120° ,, —	276·23 ,,
130° ,, —	404·32 ,,	140° ,, —	629·62 ,,

In order to avoid stoppages in the pipe connections, due to sublimation, it would be necessary to cool the gas as nearly as possible to a temperature corresponding to that of the gas in the buried mains; but as it is almost impossible to do this during cold weather, it becomes necessary to remove the naphthalene from the gas by means of a suitable extracting medium.

Large v. Small Charges.

S—The relation between the volume of the charge of coal and the volume of the retort, or the relation between the area of the cross section of the charge and that of the cross section of the retort, has a very decided influence upon the quality of the gas produced, and also upon the amount of trouble experienced from stoppages in the standpipes and thickening of the tar in the hydraulic main. The quality of gas is at its best (other things being equal), and the least trouble is experienced, when the volume of the charge is such as to almost completely fill the retort. The reason of this can readily be seen when the effects produced upon the coal and gas by exposure to the heat to which they are subjected are considered. When the charge is first put into the retort, the temperature of the coal and all the portion of the surface of the retort covered by the coal is low, and the products of distillation are hydrocarbons of high boiling points, that exist as vapours at the temperature in the retort, but condense to liquid when cooled to atmospheric temperatures. As the charge becomes heated, however, hydrocarbons of low boiling points are given off which will remain in the state of gas or vapour at atmospheric temperatures. The interior surface of the retort has by this time again reached its ordinary high temperature; and as the hydrocarbons evolved from the coal pass on their way to the standpipe through the space left above the charge, they are exposed both to contact with this hot surface and to heat radiated from it. The effect of this exposure is to break-up the more complex hydrocarbons and form hydrogen, simpler hydrocarbons, and free carbon; and given a temperature sufficiently high, and an exposure of sufficient length, the final result would be the formation of gas consisting of hydrogen and marsh gas, with no higher hydrocarbons, and the setting free of a large amount of carbon. Such a gas would be non-luminous; so that, although a certain amount of this breaking-up of the higher hydrocarbons after they are evolved from the coal is required to produce a permanent gas (especially at the beginning of the distillation), it is important that this portion should not be carried too far.

Gases after their formation should pass as soon as possible into a somewhat lower temperature, since the heavy hydrocarbons or illuminants will be deteriorated by further breaking-down if they are subject to too long an exposure to the high temperatures at which the olefine illuminants are best broken up. The length of time during which the gas will be exposed to this heat depends upon the velocity with which it travels; and this velocity in turn depends upon the area of the cross part of the retort that is not taken up by the charge, and upon the rate at which the gas is being made. An increase in the volume of the charge for a given size of retort will, therefore, increase the velocity with which the gas passes to the standpipes—first, by reducing the area of the space through which it passes, and, secondly, by increasing the rate at which the gas is made. The combined result is that the gas remains exposed to the action of the heated surface of the retort for a much shorter time, and is, therefore, much less affected by this exposure. It is true that, although the gas is less exposed to a radiant heat when the space is small and the velocity great, a large percentage of it is brought into actual contact with the surface of the retort, owing to the increase in the ratio between the perimeter and the area of a polygon that occurs when the area is reduced, and that is also exposed to contact with the greater amount of heated surface as it escapes from the interior of the charge. But experience shows that the combined effect of the radiant heat and the contact with the heated surface in the space above the charges is less harmful when the space is small, and contact with the heated portion of the charge does not have as much effect as contact with the surface of the retort. This is so because, during the period in which the greatest amount of gas is given off, the temperature of the charge is much lower than that of the retort walls (as, during the first two hours the temperature of the charge does not exceed 1200° Fahr.); while that of the interior surface of the roof of the retort is in regenerative benches at about 2000° Fahr. It is, therefore, important that the size of the retort should be so chosen that the charge which can be carbonized in the desired length of time with the heat to be carried will fill the retort as full as it is possible to have it, and still leave room for the operation of the drawing tools.

Outside Lighting of Cinematograph Houses or Frontages.—The "House Magazine" of the United Gas Improvement Company, in the course of a description of the outside lighting of a picture house in Philadelphia, describes a convenient arrangement that may be adopted for any building provided with a parapet. Four large high-power lamps are spaced at equal distances, on hinged brackets supported from the parapet, in such manner that they can readily be secured in position in front of the building, or turned round towards the back for cleaning or repair. A strong wrought-iron pipe, held firmly by tie-rods, is carried to about 3 ft. above the back of the parapet, and a horizontal arm connected by a swing joint carries the lamp. The strain is taken off the hinge, the lamp locked in position, and maintained in place under high wind, by a removable intermediate support that can be fixed on the parapet, and comprising three legs and an adjustible upright. The lighting and extinguishing are both controlled from the manager's office, by means of an electric current generated in dry batteries.

HEATING VALUE OF GASOLENE AND NATURAL GAS.

Some of the best brands of natural gas, yielding 1000 to 1100 B.Th.U. per c.ft., are ideal for motors; and a communication to "Natural Gas and Gasolene," by Mr. P. M'Donald Biddison, illustrates the fact that the excellent heating value is due to non-condensable methane rather than to easily deposited hydrocarbons.

Assuming one gallon of gasolene, which is equivalent to about 35 c.ft. of vapour, to be obtained by extraction from 10,000 c.ft. of gas, the residue available is 9965 c.ft,—a reduction in volume of 0·35 p.ct. The heating value of the gasolene is about 20,400 B.Th.U. per lb., or, as the weight of one gallon is 5·55 lbs., 113,220 B.Th.U. per gallon, which only amounts to 11·3 B.Th.U. per c.ft. If the gas had a heating value of 1000 B.Th.U. per c.ft., that of the residue would be 1000 − 11·3 = 988·7, and the heating value would be 992·17 B.Th.U. per c.ft. The actual loss of value is therefore only 0·8 p.ct. This method of calculation might be applied to any other heating value or gasolene yield—and incidentally, it may be added, to extracting benzol from coal gas.

A large number of calorimeter tests taken on samples from the same plant at different times showed a range of 1065 to 1094 B.Th.U. per c.ft., and the following reductions on extraction of gasolene: 8·3, 26·0, 29·3, 35·0, and 16·3; average 23, or 2·3 p.ct. When it is remembered that in any case a portion of the gasolene is deposited in the mains and does not reach the consumer, the loss of heating value is practically negligible; and the condensed liquid has been a source of endless trouble and expense in the past, as it softens and dissolves the rubber connections at the joints. This consideration alone has led to the installation of some of the largest extraction plants. In one instance, the amount of condensation over a considerable period was accurately measured, and found to exceed one-third of the yield obtained later by means of an absorption plant.

Mantle Lighting in Large American Cities.

Technological Paper No. 99 of the United States Bureau of Standards was one by Mr. R. S. M'Bride and Mr. G. E. Reinicker, and dealt with "Gas-Mantle Lighting Conditions in Ten Large Cities in the United States." The number of the "Journal of the Franklin Institute" for September gave the following abstract of the paper: From a careful inspection of about 4500 gas-mantle lamps in service in ten cities, a summary of the condition of mantles, glassware, pilot light, and other particulars was made, in order to determine to what extent the customer benefited through periodic maintenance service. By these observations, it was found that a lamp not on regular maintenance is likely to be defective five-and-a-half times as frequently as a lamp which is regularly maintained. Also, it is shown that, on the average, one in three of the lamps on regular maintenance was not in good condition; whereas the defects noticed in the lamps not so maintained average more than one for every lamp. The principal defects in maintenance systems were also investigated; and one satisfactory system of estimating the expenses for maintenance work, together with a set of unit costs, was presented, based upon the analysis of the operation of ten gas companies. A suggested table of costs for each type of unit was given.

Coke from Peat.

The Paris "La Chronique Industrielle," Vol. XL., p. 7, says that the Peat, Coal, and Oil Syndicate of Doncaster is developing a new method for treating a special variety of dry black peat, and converting it into a hard foundry coke; the bye-products being tar and tarry liquids, from which automobile oils can be obtained by distillation. It is not claimed that all varieties of peat can be profitably used; but it is said that hundreds of acres, containing some millions of tons of peat, can be commercially utilized by this process. The black layer at the bottom of the bog is most suitable for the manufacture of coke. This material is freed of its excess of water, and subjected to a carbonizing process by means of which bye-products are recovered—the residue being a soft and friable coke. Notwithstanding that peat coke has lower sulphur content than any other combustible, up to this time its insufficient hardness has been an obstacle to its application in blast-furnace operation. This fault, it is claimed, has been overcome; and a hard, strong, and pure coke is now obtained. A German chemist has proved by analysis that 1000 tons of air-dried peat will produce 400 tons of coke, 40 tons of tar, and 400 tons of tarry liquid. The tar can be further distilled to yield 18 tons of crude oil, 2 tons of creosote, 2 tons of pitch, and 8 tons of paraffin. The tarry liquid will yield 4 tons of sulphate of ammonia, 6 tons of acetate of lime, and 2 tons of methyl alcohol. It is estimated that there will be a profit of 90 c. on every ton of peat so treated.

Prospective Natural Gas Shortage.—The United Natural Gas Company, as well as all other companies in Ohio, have, says the New York "Gas Age," served notice on consumers that they may expect a shortage of gas during the extremely cold months of the coming winter. The gas companies have been drilling many wells; and while they have encountered a few failures in drilling, they have not increased the total supply greatly, because many of the wells have had low pressure. The continued high price of coal was one of the factors that caused a heavy consumpion of gas.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Damaged Gas Capital.

Sir,—In your editorial on "Damaged Gas Capital," you state that you are impressed with "the fictitious character of the application of the so-called theoretical principles on which standard prices are supposed to be fixed." And you give as a reason the varying margins between standard price and selling price. In taking this view, it seems to me that you have overlooked the fact that some companies have been working under a sliding-scale for much longer periods than others, and consequently have had a better opportunity of making economies and reducing the selling price. Another cause of divergence is the history of the undertaking subsequent to the institution of the sliding-scale.

There are many instances of companies who came under the sliding-scale at a comparatively early period of their existence, and whose undertakings have since expanded very largely owing to the rapid extension of their district of supply. In such cases, the economies due to an increased scale of manufacture have operated to make the difference between selling price and standard a large one.

I have an instance in my mind where the works were small and old-fashioned, and the standard was fixed at 4s. 6d. Since then the district has expanded at a very rapid rate, and the pre-war selling price was 2s. 9d. It does not, however, follow that the standard was not determined in accordance with the theoretical principles; and, as a matter of fact, I know that in this instance it was.

On the other hand, there are companies who do not come under the provisions of the sliding-scale until they have arrived at a stage when extremely rapid expansion is unlikely. If such undertakings are up to date, and have been equipped with labour-saving appliances, the probable savings which can be effected are comparatively small; and consequently the margin between standard price and selling price is likely also to be small. This may go to show a weak point in the action of the sliding-scale; but that is another story, and does not affect the present discussion.

That error is a human attribute, has long since passed into an aphorism; and companies, local authorities, and even parliamentary committees, being human, are not free from it. Mistakes, no doubt, are made in fixing standard prices. Only it does not follow that there is necessarily any fictitious character in the application of theoretical principles, because some companies have large margins and others small margins between the selling price and the standard price.

Arthur Valon.

5, *Victoria Street, S.W., Oct.* 6, 1917.

Fuel Economy Possibilities in Brass-Melting Furnaces.

Sir,—May I be permitted to refer to your editorial remarks, in the current issue of the "Journal," upon the paper that I read at the recent meeting of the Institute of Metals?

To the written communications that you publish and to others that have appeared in the Technical Press by the same authors I am unable to reply except through the "Journal of the Institute of Metals." Will you, however, allow me to draw your readers' attention to a statement made in a portion of my paper that you did not reprint, to the effect that, in order to arrive at the precise value of gaseous fuel, one must consider the importance of the bye-products, such as those you mention?

I was not, however, then considering the relative intrinsic merits of each system of melting, whether from the point of view of total running costs or the value of bye-products, but only so far as actual quantities of coal as mined were concerned.

I would also like to state that, at the meeting, I especially referred to the greater economy that would be introduced by the combination of coal gas-fired furnaces and producer-gas plant, which latter would directly use up the gas coke produced.

You have no stronger advocate for the adoption of gas-firing for crucible melting furnaces than myself; and I have clearly stated the advantages of this system on many occasions.

I maintain, however, that present-day efficiencies of gas-furnaces are a long way below what these should be, and I hope will be, in the near future. This being so, the day will not be far distant when we shall be able to reduce present gas consumption rates by 50 p.ct. or so. It was with this end in view that I suggested at the meeting an improved type of crucible melting-furnace.

At the moment, therefore, I maintain that less coal, by a very considerable amount, need be mined, if used in powdered form for metal melting, than the quantities of coal required for any other system of heat-generation by means of this fuel.

The well-known difficulties consequent upon burning powdered coal, to which you refer, are by no means insuperable; but with a considerably reduced gas consumption for metal melting, which we hope will be shortly realized, the whole question will then perhaps bear an entirely different aspect.

Perhaps you will permit me to refer to this matter again at a later date.

L. C. Harvey.

Malden, Surrey, Oct. 6, 1917.

Mr. Ionides and the "Captive Fire" Light.

Sir,—In answer to Mr. Clark's letter in your issue of the 2nd inst., I would inform your readers that, in the paper I put before the Institute of Metals, I indicated a comparison between a "Captive Fire" light and an atmospheric burner. For the sake of comparison, I referred to "Curve C" of Mr. Clark's polar curves in your issue of May 4, 1915. Should I have taken "Curve D," instead of "C," to that extent I stand corrected; but the matter of 10 candles does not in the least affect my argument.

Mr. Clark made some observations at the meeting; and he has now, in his letter, taken upon himself to suggest that this comparison was misleading, and that I owe someone an apology. If I owe an apology, it is solely to a "Captive Fire" light.

(1) I announced in my paper that 130 to 150 candle power could be obtained with under 3 c.ft. of gas an hour. I did not state how much under, advisedly; and, anticipating irrelevant remarks, I measured "Captive Fire" in terms of atmospheric burner.

(2) My demonstration consisted of a "Captive Fire" light, an atmospheric burner made by Mr. Clark's own Company, and two meters—one attached to each light. The meters showed that the "Captive Fire" light consumed 1·85 c.ft. of gas an hour, and the atmospheric burner 6·6 c.ft.; and anybody in the room could see with the naked eye that the "Captive Fire" light was superior in candle power to that of the atmospheric burner.

It necessarily follows that whatever the candle power per cubic foot the atmospheric burner yielded, the "Captive Fire" light gave at least three times that quantity, inasmuch as it consumed barely one-third of the gas. In my paper, I merely indicated twice the candle power per cubic foot, at the same pressure. It is clear, therefore, that I did not mislead anybody, as Mr. Clark would have you believe. I did not overstate the superiority of the "Captive Fire" light. The reverse was the fact.

No apology is required for claiming less than I demonstrate, nor are the so-called "elements of illuminating engineering" in any way necessary to show that the "Captive Fire" system of lighting is at least three times superior in candle power, at the same pressure, to any other known system.

Alex. C. Ionides, Jun.

34, *Porchester Terrace, W., Oct.* 4, 1917.

REGISTER OF PATENTS.

Mechanical Gas Lighter.—No. 101,717.

Larsen, C. F., of Portland, Oregon, U.S.A.

No. 13,995; Oct. 2, 1916.

The device here referred to is adapted to be employed for lighting gas, &c., where a spark is required; and it provides *inter alia* novel means for actuating a rack bar, which, in turn, rotates an abrasive wheel.

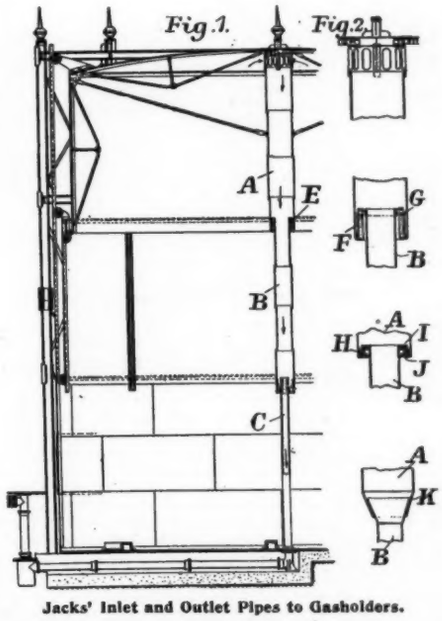
The device consists of a support having the general outline of a pistol and embodying a barrel and an angularly disposed grip. The barrel is provided adjacent its muzzle with an outlet, with an abrasive wheel journaled in the barrel adjacent the outlet. A pinion is mounted to move with the abrasive wheel; while there is a rack bar housed in the barrel and meshing with the pinion. Means are provided (accessible from the outside of the support and at the breech of the barrel) for actuating the rack bar, which drives a pyrophoric element slidable in the barrel and co-acting with the abrasive wheel. Spring means are provided for advancing the pyrophoric element—the mechanism being carried by the barrel and located below a portion of the barrel, for adjusting the spring.

Gasholders.—No. 109,274.

Jacks, T., of Ruthin, North Wales.

No. 8903; June 24, 1916.

According to this invention, the gas egresses from the top part of the holder are by way of a conduit in the interior—the gas being admitted in the ordinary way; so that, after entering the lower part of the holder, it has to ascend within the interior before leaving at the top.



Jacks' Inlet and Outlet Pipes to Gasholders.

Fig. 1 is a vertical section illustrating the telescopic supply pipes. Fig. 2 is an enlarged section of the top of the pipe. Figs. 3, 4, and 5

are sections of three forms of telescopic gas-tight joint (to which, however, no claim is made *per se*).

The pipes A B are suspended from the crown of the holder immediately above the usual outlet pipe C. The pipe A is secured to the crown of the holder; while B is suspended from A by a gas-tight point E. The lower end of B telescopically engages with the supply pipe C; so that the joint F between the two is always below the level of the water.

Perforations in the top of the pipe A admit the gas into the pipe; and the telescopic joint E between A and B is rendered gas-tight by a water seal, such as fig. 3, in which the water is contained in the annular channel F, within which the annular turned-over flange G of the pipe B is normally supported. The gas-tight joint may, however, be effected as in fig. 4, where an annular ring of purified rubber H forms the joint between the flange I of the pipe B and the flange J of the pipe A. As in fig. 5, it may be formed by a cone-shaped end K to the pipe A, and a similar, but reversed, shape of end to the pipe B.

Gas-Supply Regulators or Governors.—No. 109,199.

Williams, J., and Mayall, W. H., of Hollinwood, Oldham.

No. 1038; Jan. 20, 1917.

These regulators or governors are especially applicable for use in connection with incandescent gas-burners, burners of gas stoves, fires, heaters, and furnaces, and also in connection with gas-engines. The invention has particular reference to the regulators or governors described in patent No. 12,968 of 1915.

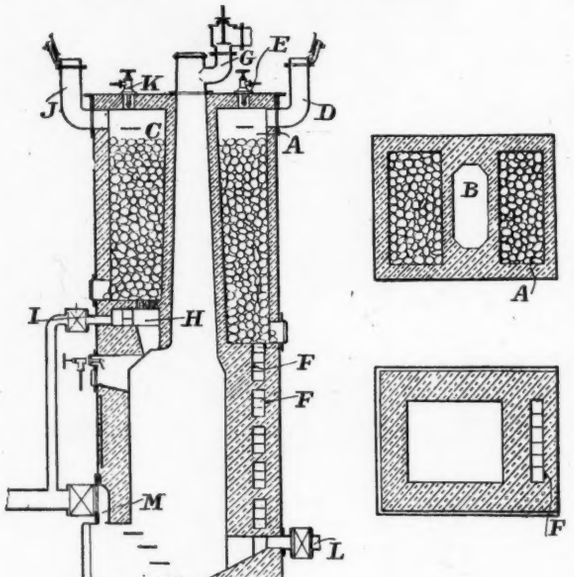
According to the present invention, the patentees propose to employ the vertical-type regulator or governor described in the 1915 patent, arranged in the inverted vertical or horizontal position—normally holding the head of the floating needle valve away from the inner end of the inwardly projecting sleeve on the cap of the adjustable inner casing, through which the stem of the valve passes. For opening the valve again on a fall in gas pressure following a partial closing of the valve under an increase in pressure, there is fitted between the cap and the valve head and around the sleeve a light spring of only sufficient strength to support the valve.

Gas-Producers.—No. 109,323.

Tully, C. B., and Yeo, O. E., of Victoria Street, Westminster.

No. 13,6[illegible]; Sept. 26, 1916.

This invention has reference to gas-producers designed to make water gas, carburetted hydrogen, or other gas in which the necessary steam is generated within a part of the producer itself.



Tully and Yeo's Gas Generator.

The illustration shows in vertical section one construction of such a producer, embodying steam generating and superheating chambers and an oil-cracking chamber. There are also horizontal sections of the top and bottom parts of the producer.

A steam generating chamber A is formed in the upper part of the producer between the outer wall and the fuel supply chamber B—in this case at a part opposite to the oil-cracking chamber C. At the top is a gas outlet pipe D, with a water supply nozzle E. It is charged with pieces of refractory material. The lower end of the chamber is connected to the upper end of a steam superheating chamber F, formed in the part of the producer wall which surrounds the gas generating chamber. It is provided with bricks, arranged chequerwise—its lower end being in communication with the lower end of the generating chamber. The gas outlet pipe is at G.

The oil-cracking chamber has a perforated bottom above an air and gas mixing and combustion chamber H in communication with the upper part of the gas generating chamber and with an air inlet I. The chamber is provided at the top with a gas outlet pipe J controlled by a valve, and with an oil supply nozzle K. It is charged with pieces of refractory material through which gas, produced during the ordinary blowing stage, with air is caused to flow. L is a pipe through which gas can be drawn from the bottom of the generator.

In this arrangement for heating the steam generating chamber A during the blowing stage, the highly-heated gas produced by the passage of air admitted through the inlet M only through the small depth of the mass of fuel between the grate and the lower end of the chamber F (and composed mainly of carbon dioxide and nitrogen) passes upward so as to raise the various parts to a high temperature—the gas passing away through the outlet pipe D. Air is caused simultaneously to pass upward through the mass of fuel in A to raise it to incandescence; and the resulting producer gas is led away through the mixing chamber H, oil-cracking chamber C, and gas outlet pipe J. In this way, the refractory material in C will be raised to a high temperature, which can be increased by admitting air to burn the gas before it enters the chamber. When the blowing stage is finished, the oil is caused to enter, and, by contact with the heated material, is converted into gas that is delivered through the bottom of the chamber direct into the mass of incandescent fuel, "whereby it serves to enrich the gas that is drawn off through the outlet pipe L."

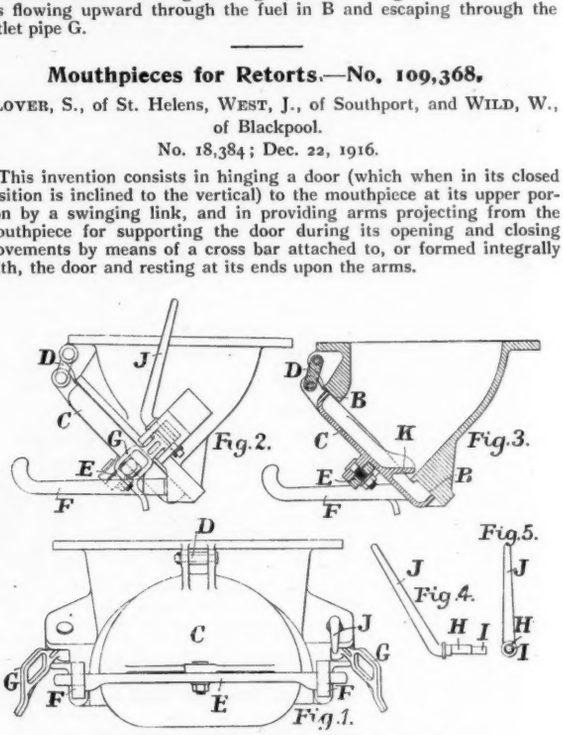
When water gas is to be produced, the valve on the outlet pipe G is opened and water admitted to A. The resulting steam flows downward through, and is superheated in, the chamber F, and enters the lower portion of the mass of incandescent fuel and, by passing upward, is converted into water gas. At the same time oil is admitted, and converted into gas, which enters the upper part of the generator and mixes with the rising water gas; the resulting carburetted water gas flowing upward through the fuel in B and escaping through the outlet pipe G.

Mouthpieces for Retorts.—No. 109,368.

Glover, S., of St. Helens, West, J., of Southport, and Wild, W., of Blackpool.

No. 18,384; Dec. 22, 1916.

This invention consists in hinging a door (which when in its closed position is inclined to the vertical) to the mouthpiece at its upper portion by a swinging link, and in providing arms projecting from the mouthpiece for supporting the door during its opening and closing movements by means of a cross bar attached to, or formed integrally with, the door and resting at its ends upon the arms.



Glover, West, and Wild's Retort-Lid Fastening.

Fig. 1 is a front elevation of a retort mouthpiece with the door in its open position. Fig. 2 is an end view, and fig. 3 a sectional end view of fig. 1, but with the door in the closed position. Figs. 4 and 5 are detail views of a locking pin for the door.

As shown, the mouthpiece has its door jointing face B at such an angle to the vertical that anything tending to collect on it flows into the door C, which is shaped to receive it. By this means, the jointing surface is protected from any corrosive action. The door is secured to the mouthpiece at its upper part by a swinging link D, and has a horizontal crossbar E attached to it which rides at its ends upon the two arms F projecting from the mouthpiece and having hook-shaped ends to limit the opening of the door. Swinging catchpieces G engage the ends of the cross-pieces when the door is closed—one catch-piece hinging about an eccentrically disposed portion H of the pivot pin I; so that by turning the extended end J of the pin its catch-piece draws the door tightly upon the mouthpiece. The door has a lip-like projection K on its inner side, which serves to protect the lower edges of the door against damage from falling coke or the like when the door is open.

Effect of Altered Coal Supplies at Barrow.—The Barrow Corporation Gas Committee last Thursday issued a notice to the consumers in the borough regretting any inconveniences caused by the shortage of the gas supply, due to their inability to obtain the necessary supplies of suitable raw materials. They said every effort was being made to provide and maintain an efficient supply; and it was hoped that further inconvenience would be avoided. The Gas Manager (Mr. F. Chadderton) had previously reported to his Committee that the coals received from Northumberland and Durham were not nearly so good as the coal from Yorkshire, with the result that the daily make of gas had been reduced. In regard to the coal supplies, Mr. T. Hardie, of Newcastle-on-Tyne, has been requested to investigate and advise as to an improvement.

MISCELLANEOUS NEWS.

GAS SHAREHOLDERS AND VOTING POWERS.

A Discussion at Derby.

At a meeting of the Derby Town Council last Wednesday, Alderman Hart, who is interested in the Derby Gas Company, moved: "That the Town Clerk be instructed to take counsel's opinion as to the correct interpretation of section 22 (3) of the Municipal Corporations Act in connection with the ruling of the Mayor that members of the Council, being shareholders in the Derby Gas Company, are, under the above section, prohibited from taking part in any discussion of the proposed agreement with the British Cellulose Company, Ltd., for the supply of electricity; that the case, when drawn up by the Town Clerk, be submitted for approval to the Special Purposes Committee; and that the said Committee shall decide upon the counsel to be engaged." He (Alderman Hart) read a letter he had written to the Mayor, in which he quoted the following section of the Act: "A member of the Council shall not vote or take part in the discussion of any matter before the Council or a Committee in which he had directly or indirectly, by himself or by his partner, any pecuniary interest." The letter concluded: "In view of your intimation that you would be reluctantly compelled to rule that I was debarred from taking part in the discussion, I have decided to absent myself from the meeting." As he received no reply, he did not attend any of the three secret meetings of the Council; and he contended that the Mayor's decision was altogether irregular. Through it he had been prevented from taking part in the discussion of a very important matter, involving an expenditure of something like £90,000. Therefore, he took the opportunity of seeking a higher authority as to the correct interpretation of the Act, one section of which provided that: "A person shall be disqualified for being elected and for being a councillor if and while he had directly, or indirectly by himself or his partner, any share or interest in any contract or employment with, by, or on behalf of, the Council; but a person shall not be so disqualified by reason only of his having any share or interest in any company which contracts with the Council for lighting, the supply of water, or insuring against fire, &c." If the Mayor's ruling was to be put into operation, many members would be practically disqualified from taking part in some important discussions. He did not know who were the parties responsible for advising the Mayor; but he did not think any of them believed that he was opposing their procedure because he was financially interested. When the establishment of the electricity works was under consideration 20 years ago, he exercised his right to discuss the proposal, and no action was then taken as to his legal position; and he strongly resented the new course that had been adopted.

The Mayor said that on July 21 he distinctly told Alderman Hart that if he rose to speak he should not rule him out of order; but if any member of the Council challenged the position, he should be compelled to rely on the decision of the Town Clerk, and to act on the interpretation of the law given by that official. He had been particularly aggrieved at some of Alderman Hart's remarks; and to accuse them of any desire secretly to put the veto on him was not fair. He had an intimation that the right of Alderman Hart to take part in the discussion might be challenged; and he consulted the Town Clerk on the point and left him to decide. His decision was based on the Town Clerk's interpretation of the law; and he agreed that it was desirable that further legal advice should be obtained.

Ultimately the resolution was carried.

REIGATE COUNCILLORS AND THE PRICE OF GAS.

The receipt of a notification from the Gas Company of a rise in the price of gas led to much discussion at the last meeting of the Reigate Town Council. The Company wrote regretting that as from the half-quarter (Aug. 11) the price would have to be raised 4d. per 1000 c.ft. to ordinary consumers; while in the case of slot-meters, the amount of gas would be reduced from 18 to 16 c.ft. for one penny. This increase, they said, was caused by the heavy costs of manufacture. Labour charges had risen considerably; and the cost of coal as compared with 1914 had doubled, largely owing to the rate of freightage, which had been as high as 21s. per ton, as against 3s. before the war.

Mr. HANDSCOMB pointed out that this increase would make the price 4s. 6d. per 1000 c.ft.; and he said there was great dissatisfaction among the consumers. Apparently, it had been decided upon in order that the dividend of 10 p.ct. might be maintained. No one should object to a reasonable return upon investment of capital. It was quite understood that the Company's expenses had been increased; but surely they should be prepared to share the extra burdens with the consumers. It was not as if the Company had not had good times in the past. In respect of the year ending June, 1913, twelve months before the outbreak of war, they distributed a 10 p.ct. dividend; and, as this did not by any means exhaust their profits, they paid in addition a 2 p.ct. bonus. Against this increased price of 4s. 6d., the price in Redhill was 3s. 10d. So far from the Redhill Company taking the lead and the Reigate Company following suit, the Redhill Company had not put up their price to anything like the same extent. He ventured to think, however, that the Redhill Company were not altogether influenced by considerations for the consumers. They were controlled by Act of Parliament; and the Legislature had taken the view that a dividend of 10 p.ct. should be considered the standard dividend, and 3s. 6d. a standard price for gas. The result was, as the price of gas went up beyond 3s. 6d., the dividend of 10 p.ct. went down. This was a very fair and reasonable arrangement. If the Reigate Company were under the same provisions, the present price of 4s. 6d. would cost them 3 p.ct. in their dividends, and they would be reduced to a paltry 7 p.ct. The Reigate Company were not under legislative control in the same way as the Redhill Company; but should occasion require, the Corporation were in a position to exercise very effective control over the Company's operations. It was to be hoped the Council would not be compelled to exercise their powers to secure that both the price charged to the consumers and the dividends paid to the shareholders were kept within reasonable limits.

The MAYOR (Alderman T. Malcomson) remarked that it was "a very exorbitant" charge; and if they were to take effective action, now was the time to do so.

Alderman BARNES said the most effective action they could take would be to approach the Redhill Company, who had parliamentary powers over the whole district, and tell them if they applied for powers to take over this Company the Council would support them, on account of the enormous increase in the price of gas in Reigate. When it was proposed some years ago that the Corporation should take the Company over, the ratepayers refused.

Alderman INCE characterized the remedy suggested by Alderman Barnes as being worse than the disease. What was needed was that the Council should exercise the prerogatives they had. Both Companies were supplying an inferior article (nothing like up to the standard), and as they had the Government behind them, the Council could do nothing in that respect. They could put an effectual barrier upon the Reigate Company, if they chose to proceed with these exorbitant exactions. He thought the Council and the ratepayers were greatly indebted to Mr. Handscomb for bringing the matter forward. He hoped the Council would not entertain any idea which would set up in their midst a monopoly such as Mr. Barnes now desired.

Alderman BARNES: I am not desirous at all. Of two evils, I choose the less.

Alderman INCE said, unfortunately, it was the greater. He would move that the Town Clerk be instructed to make representations to the Reigate Company upon the proposed increase in the price of gas, and inform them that if these prices were insisted upon the Council would exercise the powers they possessed.

Mr. GEDGE thought it would be well for a statement to be made concerning the powers the Council possessed.

The MAYOR replied that he thought the Company would understand what they were.

The proposal was then put and carried.

NOTTINGHAM'S HIGHER GAS PRICES.

£70,000 for Suggested New Work.

Although there was no formal opposition to the proposals embodied in the Nottingham Gas Committee's report, presented at a meeting of the Corporation last Monday week, regarding a further increase in the price of gas, the recommendation of which Alderman Albert Ball moved the adoption was received with ill-disguised chagrin. To such an extent has the revenue of the undertaking been drawn upon in relief of rates, that criticism was disarmed in advance; the discussion side-tracking into a tilt against the rapaciousness of colliery owners, and evolving the proposition that the Corporation might advantageously exploit a pit of its own. The more immediately practical business announcement was, however, embodied in the indication by the Chairman of the Committee of a possible expenditure, as soon as war conditions are at an end, of an amount approximating £70,000 for a new gasholder, which is badly needed. In this connection, it may be recalled that, *pari passu* with the city's own increasing requirements, the demands of consumers beyond the municipal area have developed largely in recent years; and storage capacity on a much greater scale than is afforded at present at the chief carbonizing works is, in the Committee's view, absolutely needful. In face of the large process of reconstruction involved in the installation of the Glover-West verticals at Radford, and the newer plant of the Woodall-Duckham type at Basford, the prospective expenditure represented formidable considerations, in relation to which the Chairman reiterated the importance attaching to establishing ample financial reserves. Alderman Ball's policy has been of the "pay as you go on" order, with the result that the borrowing of money for the execution of essential work is entirely excluded from the plan of his Committee.

The report of which he moved the adoption was limited in its application of increased prices to gas used solely for lighting purposes. It may be recalled that the last increase of 12½ p.ct. was made in June, 1915; and in the interval the only additional rate imposed has been for the gas supplied for power and gassing. The new rate for illuminating purposes is to be 2s. 10d. per 1000 c.ft., if the consumption be under a million c.ft. per quarter, 2s. 9d. if a million c.ft. and under four millions, and 2s. 8d. if four million c.ft. and upwards.

Alderman Ball drew a somewhat dismal picture regarding the residuals market, explaining also that the main contributory elements to the present unsatisfactory position are represented by these figures: A doubling of the price of coal upon pre-war rates; an advance of from 100 to 200 p.ct. upon fire-clay materials; of 57 p.ct. upon cast-iron mains; of 72 p.ct. upon lead and compo pipes; of 210 p.ct. upon brass goods; and of about 90 p.ct. on meters. The cost of labour has likewise increased by 40 p.ct.; while, to further accentuate the difficulties, iron and steel goods have jumped up in price from 100 to 150 p.ct. General stores are responsible for an increase of 100 p.ct. He pointed out that the Committee had been handicapped by the fact that prices of ammonia, creosote, carbolic acid, and naphthalene have been restricted; coke being the only product for which there is a free market. He was at pains to explain that, even when the proposed advance comes into operation, the price of gas to ordinary consumers will only show an increase of 21 p.ct. over pre-war charges; while the advance to prepayment consumers has merely been 8½ p.ct.

In regard to the prospective expenditure of £70,000 on a new gasholder, Mr. Offler invited an explanation of the apparently conflicting statement that coal had doubled in price for gas-making purposes; while it was understood the Government Controller had limited the increase to 4s. a ton. He suggested that if matters continued upon the present exorbitant basis, the Corporation might as well embark upon colliery proprietorship.

In reply, Alderman Ball said the Coal Prices Limitation Order was a

farce. A deputation had been to London to see the authorities regarding it; and the Government's representative had referred them to a Committee in the county which consisted of coal owners, who regulated the prices. The increase was supposed to be 4s. a ton upon pre-war figures; but colliery owners were not able to supply coal, and those who wanted it had to make the best bargain they could do. It would no doubt be a good investment to buy a colliery, if they could get the right one; but it was of no use acquiring a pit which had been three-parts worked out. With regard to residuals, the price of pitch now was only 18s. a ton, compared with 50s. before the war. The drop had been caused by the difficulty of transporting pitch to the Continent, where it was formerly used for briquette making. He warned the Council that, unless the report was adopted, the gas undertaking would make a loss instead of a profit. Last year the profits were down £20,000; and this year they would be down more. The price of gas might hereafter have to be still further increased, unless matters changed. When necessary alterations could be effected, pre-payment meter users would certainly have to pay more, they not being included in the present augmented list, owing to the difficulty of obtaining labour to make alterations to the appliances for checking purposes.

NEWCASTLE-UNDER-LYME GAS-WORKS REPORT.

At a meeting of the Gas Committee of the Newcastle-under-Lyme Corporation, the Auditor (Mr. J. C. Bladen) reported that the revenue account showed a gross profit on the year's working of the gas undertaking amounting to £2994, as compared with £4473 for the previous year. There was a total decrease in revenue of £1616; while the expenditure was reduced by only £137. The loan charges came to £4152; so that the loss for the year was £1157, as compared with a profit for the previous year of £310. Adding the loss for the year to the debit balance of profit and loss account at March 31, 1916, there is now a total debit balance on revenue account of £1601.

The Gas Manager (Mr. F. L. Wimhurst) reported that no expenditure had been incurred on capital account. Under the revenue account, coal had cost less, owing to the reduced tonnage carbonized; but the cost per ton was 20s. 2d., against 17s. 9d. a year ago. A profit of £26 had been made on purification. He thought this was the first occasion in the history of the concern on which a profit had been made under this heading. The carbonizing wages item showed a decrease, owing to less gas having been made. The cost per 1000 c.ft. made was, however, 2·31d. per 1000 c.ft., against 2·23d. Had the same rate of pay been in force that existed in 1907, the wages would have been about £560, or 1·82d. per 1000 c.ft.

The expenditure under public lighting was £141, against £433. On the income side of the revenue account, sales of gas showed a reduction of £581. The average price had been 3s. 1d. per 1000 c.ft., against 2s. 11d. last year. This small average increase was due to the decreased use of gas for lighting, &c., and a large increase in that used in gas-engines—especially at the electricity works—which latter was charged at a much lower figure than gas for lighting. To prevent a loss for the coming year would require an average increase in the prices of 3¾d. per 1000 c.ft., provided they sold the same quantity of gas. Owing to further restrictions on private lighting, the Daylight Saving Act, and the practical abolition of all outside lighting, the sales had again suffered a considerable decrease, amounting to 14·84 p.ct. on last year, which was 11 p.ct. less than 1915. It would be seen that the undertaking was suffering from the acute crisis through which many were passing. The outlook was no brighter than the past. Coal contracts were renewed at an increase of 1s. 6d., or 20s. 3d. per ton delivered at the works. Tar had been difficult to dispose of. Gas fires and apparatus were very costly, having been increased as much as 70 p.ct. This increase acted as a deterrent to prospective purchasers at a time when they would particularly like to buy. Gas-cookers for hiring purposes they could not buy for the same reason. All stores, tubing, pipes, and brass fittings had advanced from 50 to as much as 100 p.ct. Meters had advanced 60 p.ct., and could not be obtained without a permit from the Ministry of Munitions.

The Gas Committee resolved that, as and from the meter readings for the June quarter, the prices of gas be increased as follows: Ordinary meters, 4s. per 1000 c.ft., less 6d. discount for payment within one month. Slot-meters, 3s. 6d., no cash returned. Gas-engines, 3s. 6d., less 6d. discount for payment within one month. Sewage works, 3s., less 6d. discount for payment within one month. Electricity works, 2s. 3d., less 6d. discount for payment within one month.

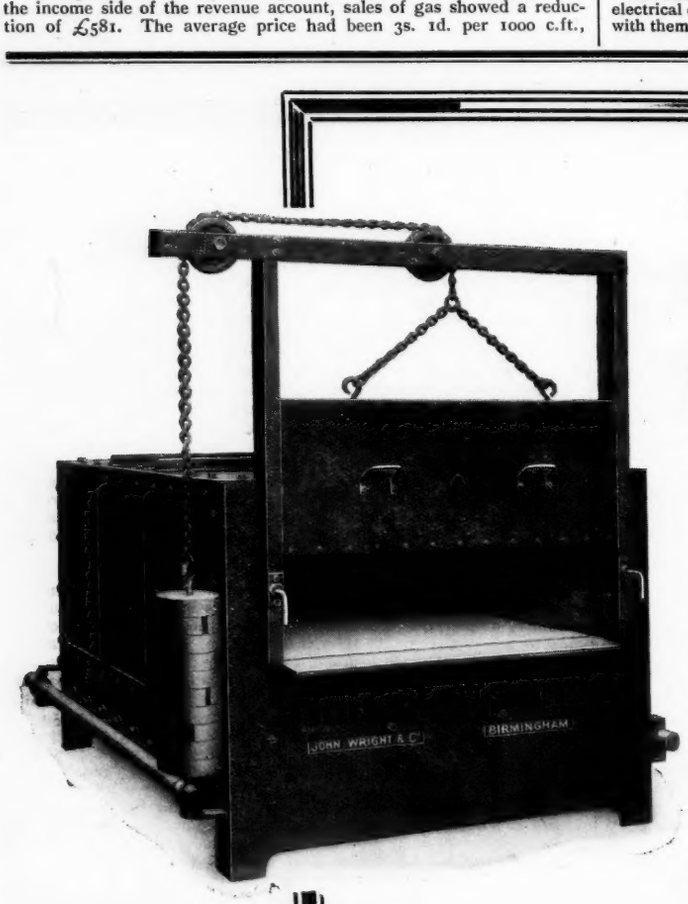
Subsequently it was arranged that the charge for gas for driving motor vehicles should be 5d. per 100 c.ft., to be paid for in multiples of 50 c.ft.

LOCAL COAL CONTROL REPRESENTATIVES.

Some details of the duties of local representatives selected by the Coal Controller are given by the South Shields Corporation. The appointments are honorary; but travelling and other expenses are allowed, according to Treasury scale. The Coal Controller has already appointed one company engineer and ten municipal engineers to represent him in various parts of the country; and their duties are defined as follows:

To visit, on behalf of the Controller, the principal towns in the area allotted.

To interview the mayor and town clerk, and, where there are such, the electrical engineer and the gas and water works engineers, and to discuss with them coal economies in every likely direction. For instance, factory



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owners who at present generate their own power by means of coal should make arrangements to take their power from an outside source, either public or private.

The Coal Controller will assist in obtaining priority for plant, machinery, motors, &c., provided a substantial coal saving can be demonstrated.

The use of locally produced coke or coke breeze in place of coal in domestic grates, factory furnaces, public-utility plants, baths and wash-houses, &c. The curtailment of those public services which entail coal consumption, such as early and late tramways running, after consultation with the Ministry of Munitions and the Ministry of Labour where munition and other workers are likely to be affected. The accumulation of stocks of coal in the summer months to provide for possible shortage in winter.

The installation of gas or electric cooking and heating appliances in public and private buildings with a view to saving coal.

Authority to disconnect classes of non-essential consumers in cases of urgent necessity, in order to enable the supply to be continued to munition and other essential consumers.

The interconnection of adjacent electrical undertakings.

To report fully in writing to the Controller the effect of each interview.

The Controller points out that it is desirable that the local authority or the local gas or electric supply company, as the case may be, should report to the local representative cases where an obvious waste of coal is being made either in public buildings, factories, or generating stations.

To report other suggestions which would result in a saving of coal.

GAS FOR GOVERNMENT HOSTELS AND WELFARE CLUBS.

Experiences at Hereford.

Owing to the exigencies of the war, the influx of a large amount of female labour has resulted in the establishment throughout the country of a number of Government hostels and welfare clubs for the benefit of girls and women. This gave the Hereford Corporation Gas Department an opportunity which was turned to good account.

All-Gas Welfare Clubs.

The premises selected for the housing of the first club were a suite of chambers comprising eighteen rooms. Gas-fires (varying in size from 10 in. to 17 in. according to the cubical contents) are fixed in all the rooms. The base of each gas-fire rests on a tiled hearth; while the back of each fire is fixed to a tiled surround, which in turn is fixed to the front of the chimney breast. Each fire is provided with a loose key-valve, by means of which the use of the fire is controlled by the matron. In the bathroom, a geyser is fixed in connection with a secondary slot-meter; so that a hot bath may be obtained for a penny. All the cooking is done on suitable sized gas-cookers; and a portable boiler provides hot water for dish-washing and cleaning.

The whole arrangement is a pronounced success, since the possibilities of gas as a reliable, convenient, and labour-saving agent have been here amply demonstrated. So successful was the application of gas to the requirements of this club, that other clubs as they sprang into existence at once turned their attention to gas.

Wherever practicable, gas-fires having columnar radiants have been fixed; but occasionally the absence of flues and other architectural limitations have precluded the use of this type of fire. Hence, in some clubs the corridors are effectively heated by means of gas-steam radiators; while syphon stoves have also been employed to advantage in comparatively small rooms.

All-Gas Government Hostels.

The premises selected for the first Government hostel comprised a commodious block of buildings previously known as the "Judges' Lodgings"—so called on account of the accommodation it afforded to the various judges during their periodic visits to the city to preside over the Assize Courts. This hostel was to be termed a clearing hostel—*i.e.*, one capable of affording temporary accommodation for female workers until they could be cleared to billets.

An inspection of the antique cooking and heating arrangements speedily resulted in their wholesale condemnation. One old-fashioned apparatus is worthy of note, in order to show the wastefulness of old-time methods of cooking. This apparatus (known as a sand-oven) consisted of a huge oven, with base filled with sand, mounted on a brick structure about a yard high. A coal-fired furnace was so arranged that the heat had to travel horizontally for about 4 ft. before it reached the base of the oven. After stoking for a number of hours, the sand eventually got hot and imparted heat to the oven above.

The requirements of the hostel were the adequate heating of the entire premises, a considerable amount of cooking, and the provision of 300 gallons of hot water per hour—to supply a number of baths and sinks and a larger number of lavatory basins. At first, some doubt was expressed as to whether gas would fulfil these requirements; and it was only by guaranteeing the success of the whole scheme for a given gas consumption that the order was secured.

The rooms were of various sizes; consequently, gas-fires varying from 14 in. to 17 in. were installed in them. A large gas-steam radiator was fixed in a small drying-room intended for the reception of coats during wet weather. Two large and suitable-sized gas-ranges were fixed in the kitchen; and these were fitted with hoods and plate racks, so that the odours of cooking were conveyed to the outer atmosphere.

Here 300 gallons of hot water per hour had to be obtained from a cylinder of 120 gallons capacity, as this was the largest cylinder available at the time. A battery of six large circulators (each having a separate thermostat) was, therefore, connected to the 120-gallon cylinder, which was fixed immediately above the circulators. An exhaust pipe was conducted from the top of the cylinder to the cold-water storage cistern, over the top of which it terminated in an inverted U bend; and from this pipe, near the top of the cylinder, all hot supplies were drawn. On account of some of the lavatory basins being some distance from the hot-water storage cylinder, a secondary

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return had to be introduced; otherwise cold water would have been drawn through the hot taps in unduly large quantities.

In order to prevent the possible freezing of the water in the water closet cisterns, a hot-water radiator was fixed near them; and another was fixed in a room which housed a range of a dozen lavatory basins. Both these radiators were supplied from the hot-water storage cylinder, and both were fitted with wheel-valves, so that the heat was available whenever required. On the completion of the work, a severe and independent test was imposed on the whole of it; and the terms of the guarantee were declared to have been fulfilled.

The success of this undertaking led to the order for a similar scheme elsewhere in the city; but only on the basis of guaranteed results. The guarantee was readily forthcoming. As a result of it, another all-gas hostel has been established, in which a dozen gas-fires, a hot-water installation, a large double range, carving table, and a pudding-boiler have been successfully fixed.

This, in turn, led to still another scheme; but no guarantee was required on this occasion—the use of gas evidently having justified itself. In this latter scheme, the fires installed ranged from 10 in. to 21 in.

In addition to the all-gas hostels and clubs which have been established, quite a number of other hostels and clubs do all their cooking, and most of their heating, by gas.

In conclusion, it may be stated (a correspondent points out) that the claims of gas have only to be properly presented in order to be fully appreciated. The labour problem has been acute for a considerable time, and it is becoming still more acute. This is precisely where the use of gas is well-nigh indispensable; and this is why it is playing such a conspicuous part in the national economy at the present time. By using gas, the labour involved in cooking, in heating water, and in uniformly warming our habitations, is reduced to a negligible quantity.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Oct.* 8.

The tone of the pitch market continues good, and the nominal price remains at 45s. per ton net f.o.b. maker's works, although it is reported that further business has been done at very much over this figure. There is considerable scarcity of solvent naphtha, and the price is advancing steadily. Business is said to have been done at 2s. 9d. to 3s. per gallon net in returnable packages. Creosote remains unchanged at 4½d. per gallon net, nominal; but business can, of course, only be done with Government sanction. Other tar products are mostly controlled by the Government, and there is nothing of special interest to record.

With regard to sulphate of ammonia, the Distribution Committee of the Food Production Department have now decided to control supplies; and all orders, unless for delivery within a 10-mile radius of makers' works, must be placed through that Department, at No. 72, Victoria Street, Westminster, S.W. 1.

Tar Products in the Provinces.

Oct. 8.

There is nothing fresh to report concerning the markets for tar products. Prices for the different articles, however, keep steady.

The average values for gas-works products during the week were: Gas-works coal tar, 24s. 6d. to 28s. 6d. Pitch, East Coast, 17s. to 18s. per ton; West Coast—Manchester 17s. 6d. to 18s. 6d., Liverpool 17s. 6d. to 18s. 6d., Clyde 18s. to 19s. nominal. Benzol, 90 p.ct., North 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7¼d. Solvent naphtha, naked, North, 2s. 2d. to 2s. 3d. Heavy naphtha, North, 1s. 4d. to 1s. 5d. Creosote, in bulk, North, 3¼d. to 3¾d. Heavy oils, in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60 p.ct., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 80s., bags included. Anthracene. "A" quality, 3d. per unit; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

The features of the market during the past week have been the continued strength of solvent naphtha and a further improvement in the Provincial position of pitch. Continental demand for the latter product still keeps the price round 48s. per ton f.o.b. London; and, owing to the availability of a small amount of tonnage, a fair quantity of pitch has been exported from the north-east coast to France at quotations considerably higher than those prevailing for home business. From 26s. to 27s. per ton f.o.b. Newcastle has been paid; while freights to Fécamp and Rouen have ruled at about 65s. per ton. There are still many difficulties in the way of any great increase in the Provincial export trade, although the demand is good. Still, the improvement is satisfactory, and encourages a better outlook. Provincial holders are now much firmer with prospective buyers, and offers of under 20s. stand very little chance of acceptance. At the same time, it must not be overlooked that production still surpasses consumption, in spite of the improved demand; and, consequently, stocks are still accumulating. The demand for solvent naphtha has been well maintained, not only for spot but for forward delivery, and a considerable shortage of supplies is to be noted. The price has reached 3s. per gallon; and in all probability a higher quotation will soon be reached. Cresylic acid keeps steady under a good demand from makers of disinfectants; but there is very little doing, apart from official orders, in creosote or carbolic acid. Naphthalenes continue to show strength on an antici-

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pated shortage in supplies during the next few months. The refined is now worth about £35 per ton; while the lower qualities of crude cannot be obtained under £5 per ton. Benzol remains unaltered, and there is little fresh news regarding the proposed Committee to watch the interests of makers. Efforts are, it is understood, to be made to secure better prices for the product now, as well as some assurance of adequate protection against imported competitive spirit after the war. It is pointed out that many makers—especially gas undertakings—have incurred heavy expense in setting up plant for the recovery of this product, and in the national interest are producing it at a loss. They are depending on after-the-war-trade to recompense themselves, and consequently do not wish the distribution of the product to pass into the control of parties interested in petrol—a competitive spirit. The range of quotations is as follows:

Aniline Oil (pure): 1s. 3d. per lb.

Benzol: 90% London, 1s. 0½d., North 10½d. to 11½d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. 6d. per gallon; crystals 40%, 1s. 3d. per lb.

Crude Tar: London 30s., Midlands 24s. 6d. to 25s. 6d.; North 25s. per ton, *ex* works.

Pitch: London 48s. f.o.b.; East Coast, 19s. to 20s. f.o.b.; West Coast—Liverpool and Manchester 18s. 6d. to 19s. 6d. f.a.s., Clyde 20s. per ton.

Solvent Naphtha: Naked London 90-190% 1s. 8d. to 1s. 9d.; North 1s. 3d. to 1s. 4d. per gallon; 90-160% naked London 2s. 10d. to 3s.; North 2s. 8d. per gallon.

Crude Naphtha: Naked 30% 8¼d. to 8¾d.; North 6¼d. to 6½d.

Naphthalene: Refined £32 10s. to £35; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 3¾d.; heavy oil, 4¼d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¾d. to 2¼d.

Cresylic Acid: 95%, 2s. 5d.; 97-99%, 2s. 6d. to 2s. 7d.; Glasgow 2s. 3d., *ex* works London and f.o.b. other ports.

Grease Oils 18° Tw. (naked), £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

The production of sulphate in most centres is quite satisfactory. Practically all the output is required for home purposes, and the quantity available for export is very small indeed. The export price, when licences can be obtained, is well up to the highest figures recorded in these reports—say, £24 10s.—and it is a matter for some surprise that the price is not higher, having regard to the export value of other fertilizers, especially nitrate of soda. It is just possible that, towards the end of this month, a few more licences may be granted. Foreign demand is good, and prices elsewhere, especially in America, are higher than ever. American manufacturers are well sold forward; but the number of resales appears to be quite small—a still higher price being looked for (it is over £30 per ton now). At home here, the agricultural demand is consistently good; and with nitrate at £27 per ton, no falling off in the demand for sulphate at £15 15s. per ton need be looked for.

Quotations (basis 25 p.ct. double bags): October-December £15 15s. per ton, January-May, 1918, £16 7s. 6d. delivered; 10s. per ton less at makers' works. Export, £24 10s. per ton f.o.b. London, Leith, Glasgow, Hull, or Liverpool.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is rather unequal, owing mainly to the irregular nature of the supply of steamers. In the foreign-going trade, high rates of freights seem to have attracted more tonnage; but coasting trade is quiet. Steam coals are generally active, with full exports. Best Northumbrian steams are 30s. per ton f.o.b.; second-class descriptions being steady at 25s. 6d. to 26s. There is an abundant supply of steam smalls; and the quotation is from 18s. 6d. to 20s. 6d. per ton. The gas coal trade shows a growing local demand; but shipping is impeded, though as much as 21s. is quoted as the freight for gas coal from the Tyne to London. For best Durham gas coals 25s. per ton f.o.b. is now firmly asked; second-class varieties are from 23s. 6d.; and "Wear Specials" are from 26s. 6d. to 30. There are some inquiries for gas coal for Scandinavia; but contracts are only slowly settled just now—the recent increase in the wages of the miners inclining coal-owners to hope for an increase in the "maximum" price chargeable. The full consumption of coking coal has some influence on the gas coal trade, and generally on that of Durham county. Coke is in heavy local demand. Gas coke, in spite of the larger output, is well taken up, especially at seaboard ports, though the freights continue at high figures.

The Strike at Aberdare.—The high-handed action of employees of the Aberdare and Aberaman Gas Company, in stopping work pending an arbitration which they had been promised, was referred to in last week's issue [p. 35]. After having received on different occasions since the beginning of the war advances in wages and bonus totalling between 9s. and 10s. a week, an application was made last June for a further 6s. a week all round. To this the Company replied that, having regard to an arbitration award issued only the previous month, they could not see their way to make any further change so soon. On Sept. 10, the men gave a week's notice; and two days before the notices expired, they were informed that Mr. Courthope Munroe, K.C., had been appointed to hear their case. They were therefore requested to withdraw their notices; but this they refused to do, and struck work. The award of the Arbitrator is that the men concerned shall receive, as from Sept. 10, by way of extra war bonus, such further advance as shall make the aggregate advance on their pre-war wages 12s. per full ordinary week.

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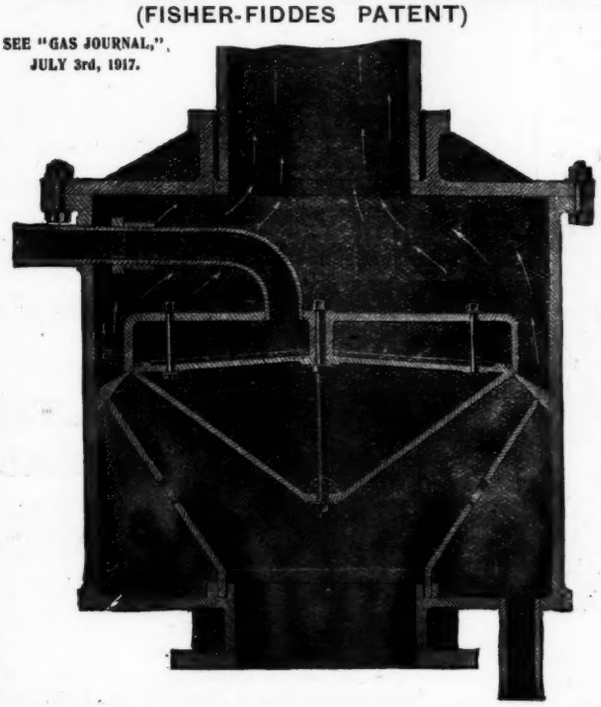

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Arbitration in Wages Disputes.

It was stated at the meeting of the Stockport Town Council last week that the Gas Engineer (Mr. S. Meunier) had submitted to the Gas Committee the award of the Committee on Production made in the claim of the National Union of General Workers, which granted to the men such a sum as would make their present war bonus up to 9s. per week, and to women such a sum as would make their war bonus up to 6s. per week. A letter was read from the Deputy Town Clerk of Manchester, stating that his Corporation had replied to the application of the Municipal Employees' Association for a war bonus of 15s. per week by offering the members of the Association the same terms as were awarded by the Committee on Production in the arbitration proceedings just referred to. A letter was read from the Chief Industrial Commissioner's Department of the Ministry of Labour, stating that a communication had been received in the Department relative to a difference that has arisen in connection with an application for an advance of wages made by the Municipal Employees' Association, on behalf of their members employed by various corporations in Lancashire; and the difference has been referred to arbitration under the Munitions of War Acts. It is proposed to arrange with the Committee on Production to hear the claim at an early date. It was decided to act with the other corporations concerned in the matter of arbitration.

Embezzlement Charge at Weymouth.

At the Weymouth Police Court, Alfred Amos was charged with embezzling various sums the property of the Weymouth Consumers' Gas Company, in whose employ he was at the time. Mr. Pengilly (who prosecuted) stated that fifteen months ago the accused was entrusted with the collecting of large sums of money from the slot-meters; and he had taken for himself small sums from many of the slot-meters per day during the collection. Steps were adopted to find where the leakage was. A man named Damer, employed by the Company, was sent to different houses to count up the money in the meters, and more particularly in the meters the subject of the charge. The collector duly came round to collect the money. In one case he gave a duplicated receipt for 6d. short, in another 4d. short, in the third 3d. short, and in the fourth case 2d. short. The Company did not press for vindictive punishment. Mr. E. Y. Wood (the Secretary) having given evidence bearing out the facts, Mr. Reed—on behalf of Amos—stated that the collection amounted to £200 weekly; and he asked if 32s. 6d. a week was a fair salary to pay a man to whom such a sum was entrusted. He put this forward in mitigation of punishment. For years accused was a labourer; and he was then put forward suddenly into a responsible position at a salary probably commensurate with his work and ability, but without that stability of character and education which would keep him in the right path. There was the temptation. The Magistrates inflicted a fine of £10, or two months' imprisonment.

Keighley Gas Profits.—During the year ended June 30, the gross profits on the Keighley Corporation gas undertaking amounted to £13,345, and the net profit to £4233. From this it is proposed to transfer £938 to the general district rate, being the cost of public lighting, to make a donation of £50 to the Keighley Victoria Hospital, and to transfer the surplus of £3244 to the gas-works renewal fund.

Price Increased at Doncaster.—In proposing to the Doncaster Town Council an increase [which was agreed to] of 3d. per 1000 c.ft. in the price of gas, Mr. Clark said the charge was fixed at 2s. 9d. in May, and a further increase was necessitated by the advance in wages, the cost of coal, and the increase in the price of material. All they would be able to do with this rise would be to square the accounts; the idea of contributing anything to the borough fund being quite out of the question.

Ossett Gas Undertaking.—The Auditor's report on the Ossett Corporation gas undertaking states that there is a loss for the year of £994, against a profit last year of £117. The charge for income-tax was £2000 more than in 1915-16; and the accounts would have been better for comparison purposes if this item had been debited to the net revenue account, and not to the trading account. This would have shown the gross profit to be nearly £1000 up, instead of £1100 down as in the printed accounts. The net deficiency now stands at £737.

Working Week at Manchester.—At a meeting of the Gas Committee of the Manchester Corporation, the Deputy Town Clerk submitted a report of an arbitration between the National Union of General Workers and the Corporation relative to the claim of the Union (on behalf of the members) for a uniform working week of 52 hours for all grades of employees in the service of the Gas Department, before the Committee on Production in London. The Committee by the award found that the claim of the Union had not been established.

Wages at Halifax.—The Halifax Corporation workmen, in the gas, electricity, and other departments, are applying for increases of wages which will bring their pay to 15s. per week above pre-war rates; and they ask that, in the event of any further increase of wages being granted to employees in the local engineering industry, the same wages shall be given to Corporation men. Their pay is at present 9s. above pre-war rates. The Finance Committee recommend that, as the question of wages was quite lately decided by the Committee on Production, the application be declined.

Steaming with Vertical Retorts.—The Engineer and Manager (Mr. R. T. Surtees) reported to the Newton-in-Makerfield Gas Committee that in recent years much had been heard of the process of steaming in the retorts, which is particularly applicable to "verticals." It consists in admitting steam through a very small nozzle to the hot coke, and in some cases has given an increased make of gas of 11 p.ct. He intended trying it on two retorts; and, if successful, he suggested it for the whole of the eight. It was a matter of small cost, and promised good results. The Committee requested him to try the effect of the process.

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Bridgwater Gas Company.

Mr. R. Y. Foley, presiding over the 83rd annual meeting of the Company, said the profits, as compared with the previous year, had decreased by about £1100. This was not to be wondered at, coal having cost fully 3s. per ton over last year's very high price; while oil used in the manufacture of carburetted water gas, which at one time was about 2½d. per gallon, could not now be purchased under 1s. 2d. The wages of labour were continually advancing; while metal goods, pipes, meters, cookers, fittings, &c., were almost prohibitive in price, and most difficult to obtain. The Company purchased during the year 612 tons less coal, but paid for the decreased quantity £202 more. Summer time and the continued severe restrictions on lighting had combined to keep down the consumption of gas; and the town also had consumed less gas for public lighting. Under the strict and legal construction of their contract with the Corporation, they were liable to pay the full contract price, whether the lamps were lit or unlit. But he felt sure the stockholders would not wish to insist on their "pound of flesh" in these unprecedented times, and would approve of the action of the Directors in handing back to the Corporation £300, which represented the actual amount saved to the Company by reason of the non-lighting of the public lamps. Last year the Company were considerably helped in their profits by the sales of residual products; but this year, largely owing to Government restrictions, the receipts from sulphate of ammonia and tar showed a very considerable falling off, coke alone giving an increase. During the whole of the past year the selling price of their gas had been the full standard price; and this had proved insufficient to yield enough profit to pay the standard dividend. The Directors recommended that, instead of raising the price of gas above the standard, £598 be taken from the reserve fund (which had during past years been created out of undivided profits for this purpose) to maintain the statutory dividends for the past year. As to the installation of continuous vertical retorts, which had been successfully working since 1913, with practically no cost for repairs, these had done splendid service; and it was difficult to imagine how the Company could have continued their operations had these not been installed. After the report and accounts had been adopted, the Chairman, in moving the re-appointment of Mr. J. Hughes Cornish as Secretary and Manager, said it reflected great credit on Mr. Cornish and the foremen and men at the works that an increased quantity of gas had been extracted from every ton of coal used during the year; while the fact that 24 million c.ft. of gas had been consumed by the slot customers, and nearly double this quantity by the ordinary ones, showed that the reduced office staff were not idle. The thanks of the stockholders were due to them all for so admirably grappling with a difficult and unprecedented situation.

New Company Announcement.—Brotherton-Ratcliffe & Co., Ltd., Registered No. 147,311, April 30, 1917; increased June 11, 1917. (P.C.) (R.C.) £50,000. (V) £1. Merchants, importers, and exporters of chemicals, dyes, and intermediate products. Registered Offices: No. 4, Fenchurch Avenue, London, E.C. 3.

Burton Wages Arbitration.—An arbitration took place last month regarding the application of certain employees of the Burton-on-Trent Corporation for a recent advance of 5s. per week to be made retrospective; and the award of the Committee on Production is: (1) That the application for payment of the 5s. per week, as and from June 18, instead of from July 23, is not established. (2) That, in view of the special circumstances prevailing in Burton-on-Trent, the war bonuses which were paid prior to July 23 are to be converted into war wages; but the last bonus of 5s. is to continue as a bonus. The Corporation on July 23 granted a war bonus of 5s. a week to workmen in their employ; and an application was put forward for this to be made retrospective to June 18, the date of the employees' original demand. It was further asked that the previous war bonuses, which amount with the present bonus to 12s., should be converted into war wages, and carry their proportion of overtime.

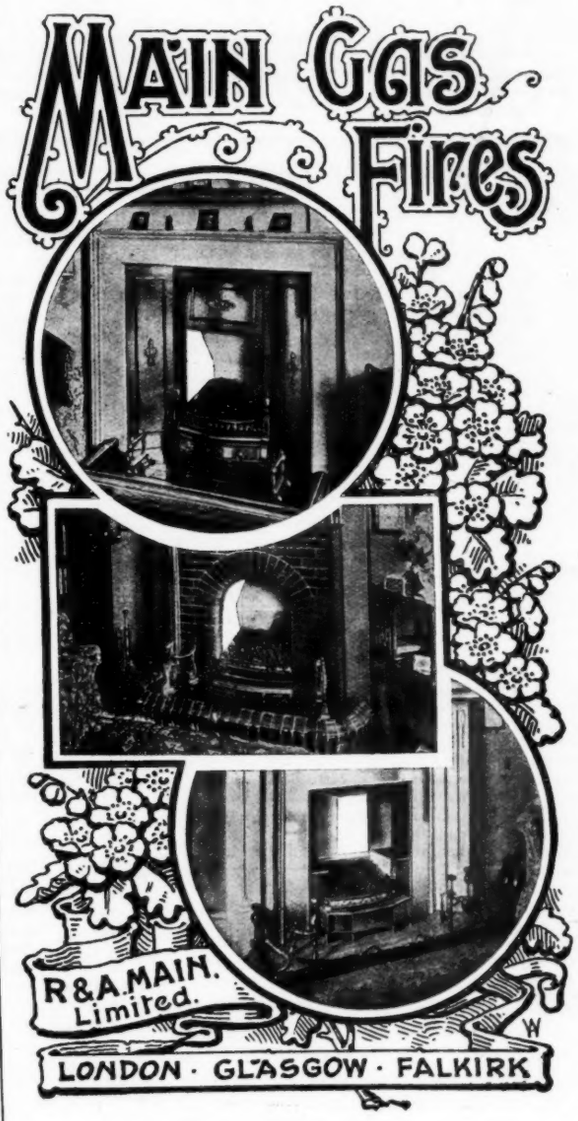
APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Oct. 3.]

Nos. 13,686—14,104.

AUGUST, J. R. C.—"Regenerative furnaces." No. 13,817.
CHALLINER, J. A.—"Containers for gas for use of motor vehicles." No. 14,069.
CHAPMAN, G. & W.—"Automatic folders for gas-containers on gas-driven vehicles." No. 14,101.
CORBITT, C. E.—"Protector for mantles." No. 13,833.
COUPER, A.—"Manufacture of refractory bricks." No. 13,906.
COX, C. W.—"Portable compressed coal-gas feed and carrier." No. 13,980.
DYER, A. W.—"Gas-bag attachment for motor-cycle and side-car, &c." No. 13,688.
ESTERLY, A. H.—"Gas-burners." No. 13,844.
GROSSMANN, J.—"Utilization of nitre-cake." No. 13,975.
HARRISON, J. R.—See Corbitt. No. 13,833.
HOOSON, H. V.—See August. No. 13,817.
KELSALL, G.—"Gas and air mixing-apparatus for internal-combustion engines." No. 13,872.
MANDLE, H. H.—"Producing hydrocarbons." No. 13,955.
MASON, H. E.—See Couper. No. 13,906.
REDWOOD, E. J.—"Valves for compressor plant, &c." No. 13,070.
REID, H. C.—"Storing gas for use in internal-combustion engines." No. 13,809.
RYDER, F.—See Kelsall. No. 13,872.
SHARPLES, P. T.—"Separating solids from liquids." No. 13,965.
SIEMENS & HALSKE AKT.-GES.—"Photometry." No. 14,096.
TARRY, T. W.—See Cox. No. 13,980.
THUMAN, F.—"Gas-producers." No. 13,770.
WHITAKER, T.—"System of carbonizing coal." No. 13,694.
YEADON, J. A.—See Whitaker. No. 13,694.

MAIN'S NEW FOLDER IS READY.



Supplies of this handy List will be sent upon application. It contains the latest information and prices of the popular "Main" Fires, Radiators, &c.

Place your Season's Orders early.

We have commenced our deliveries.

R. & A. MAIN, Ltd.,

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, PRINCES STREET, OXFORD CIRCUS, W.; 82, Gordon Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Coal Regulations and Gas Price at Ulverston.—At Ulverston, the price of gas has been increased 9d. per 1000 c.ft. This has been necessitated by the obtaining of coal from Northumberland and Durham, instead of from Yorkshire, and the consequent additional cost of 3s. 8½d. per ton.

Cirencester Gas Company, Ltd.—In submitting the report and accounts for the year ended June 30 last, the Directors stated that the revenue account reflected the abnormal times. The ever-advancing price of coal, the increasing rates and taxes, and the falling-off of the sales of gas (due to lighting restrictions and the operation of the Summer Time Act), have all contributed to reduce the profit on the year's working to the somewhat disappointing figure of £1091. However, several items of expenditure shown in the revenue have been exceptional in the past year, and will not recur. To meet the enhanced costs, the Directors have had no alternative but to further increase the charges for gas by 3d. per 1000 c.ft., to take effect from Oct. 1. Interest on the debentures and an interim dividend at the rate of 8, 4, and £5 12s. p.ct. have been paid; and the Directors recommended a further dividend of 4, 2, and £2 16s. p.ct. on the several classes of shares respectively—making 6, 3, and £4 4s. p.ct. for the year. The works, plant, and mains have all been maintained in good order out of revenue.

Harper Patent Burner Company.—A Company has been registered with a capital of £100, in £1 shares, to take over from F. D. Harper, of Workington, the benefit of certain existing inventions relating to improvements in gas-burners for heating purposes.

Wages Question at Bolton.—The Bolton Corporation Gas Committee have had before them a letter from the Chief Industrial Commissioner, Ministry of Labour, enclosing a copy of a letter received by him from the Bolton and District Gas Workers' Association, requesting that arbitration proceedings be set up in respect of applications made on behalf of their members employed by the Farnworth and Kearsley Gas Company, the Radcliffe and Pilkington Gas Company, and the Corporations of Bolton, Bury, Leigh, and Mossley, for such an advance of wages as would make the total increase 15s. per week over pre-war rates, and for existing war bonuses to be converted into war wages; and stating that, in the absence of a settlement by mutual arrangement, the Chief Industrial Commissioner proposes to refer the difference at once to arbitration, and suggesting that the matter would be facilitated by having one hearing to cover all the applications. The Committee resolved that the application be not acceded to, but that the matters be referred to the Committee on Production for decision, with an expression of opinion that the applications should be heard and dealt with at one and the same arbitration.

STOCK MARKET REPORT.

The week just closed on the Stock Exchange had its good points; but it had one feature which was less satisfactory, and that was the marked paucity of business. This, however, was largely due to the launching of the National War Bonds—formidable competitors naturally in the bidding for money awaiting investment. The Bonds are going off well, and with not too feverish an outburst of enthusiasm at the start. Certainly their terms are good enough to provide a lasting attraction. Chief among the good points were the remarkable war successes, embracing the two grand achievements in Belgium and Mesopotamia, the cumulative influence of which throughout the country wrought a most cheerful close to the week.

The gilt-edged market was a little dull at first, but was not long in brightening up, and it finished at its best. The 5 p.ct. and 4½ p.ct. War Loans were particularly strong, and Consols and Indians firm. Home Rails had a pleasant change, and hardened in response to buyers. Canadians were very dull; the passing of Grand Trunk dividends being a new cloud. Argentines bore up awhile in spite of bad traffics, but finally gave way. The Foreign Market on the whole was dull. Swedish rose, favoured by exchange. Chinese and Japanese were both steady; but Russians were dull, though partially recovering at the close. South Africans were firm. Miscellaneous adventures were irregular. Rubber became dull, but Oil advanced. Breweries and Meat concerns, too, were in request.

Business in the Gas Market was a good deal quieter. One or two of the largest issues were fairly alive, but a noticeable feature was the great number of undertakings which were quite bare of a single bargain. Only a dozen altogether were touched at all, and some of these had only one transaction apiece. There was not enough doing to indicate any predominating tendency, and changes of quotation were few. Metropolitan of Melbourne bonds were higher *ex div.*; but Gas Light ordinary and Primitiva preference were lower. In the Money Market rates relaxed.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 68¼, 68¾, 69¼, ditto preference 70¾, Imperial Continental 90, 90¼, 90½, 91, Portsea "D" 61½, 61¾, Primitiva 46s. 3d., South Metropolitan 73¼, 73½, ditto preference 95½, 95¾, South Suburban 75⅝, 76. On Tuesday, Gas Light ordinary 68¼, ditto preference 70½, Imperial Continental 89, 90, Metropolitan of Melbourne 97¾, South Metropolitan debenture 56, 56¼, Wandsworth 4 p.ct. debenture 66. On Wednesday, Continental Union 39¾, European 10¾, 11, 11 1/16, Gas Light ordinary 68, 68½, 69, ditto preference 71½, Imperial Continental 89, 89½, 90, 90¼, 90½, Primitiva preference 60s., 62s. 6d., South Metropolitan 72½, South Suburban 76¼, Wandsworth 4 p.ct. debenture 66½. On Thursday, European 10¾, 11, 11 1/16, Gas Light ordinary 67¾, 68, 68½, 68¾, Imperial Continental 89½, 90½, Primitiva 46s., ditto preference 59s. 4½d., 60s., South Metropolitan 73½. On Friday, Continental Union preference 61½, European 11 1/16, 11½, Gas Light ordinary 67¾, 67⅞, 68, 68½, Ilford "A" and "C" 92½, 92¾, Imperial Continental 90½, 91, Monte Video 7⅝, 7¾, South Metropolitan 73½, 74.

The Bank rate is 5 p.ct., as fixed on April 5.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When last Dividend.	Prev. Div. or Div. & Bonus. p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	57—62	..
1,551,868	,,	April 8	2½	4½%	Alliance & Dublin Ord.	59—64	48—53*	..
374,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	57—62	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5⅞—6¾	5—5½	..
50,000	10	Feb. 26	16	14%	Bourne-mouth Gas and Water { 10 p.c.	29—30	23—25	..
888,110	10	,,	7	7%	B 7 p.c.	15—15½	10½—11	..
115,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	9—9½	..
159,740	—	—	—	4%	4 p.c. Deb.	..	62—71	..
992,045	Stk.	Feb. 26	14	5 5/11%	Brentford A Consolid.	261—266	79—82	..
794,920	,,	,,	11	4/6	Do. B New	204—209	76—79	..
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	81—86	..
221,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—93	65—67	..
217,380	,,	Feb. 26	11	10%	Brighton & Hove Orig.	208—213	145—150	..
244,200	,,	,,	8	7%	Do. A Ord. Stk.	154—159	98—103	..
530,000	20	Mar. 26	12½	22/6	British	44—45	32—33	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	68—70	..
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	53—56	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	3—3½	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7½	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	78—79	..
1,513,280	,,	Feb. 12	5/9/4	44/-	Commercial 4 p.c. Stk.	106—108	70—72	..
560,000	,,	,,	5½	40/-	Do. 3½ p.c. do.	103—105	64—66	..
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	51—53	..
800,000	,,	,,	4	—	Continental Union Ltd.	76—79	39—41	39¾
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	61—63	61½
278,400	—	—	—	11½%	Croydon B and C 7 p.c.	..	165—175	..
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	123—125	95—100	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	10½—11½	10¾—11½
16,313,480	Stk.	Feb. 10	4/17/4	37/4	Gas Light and Coke { 4 p.c. Ord.	98—102	67—69	67½—69½
2,600,000	,,	,,	3½	3½%	3½ p.c. max.	76—79	56—58	..
4,062,235	,,	,,	4	4%	4 p.c. Con. Pref.	96—99	70—72	70½—71½
4,674,850	,,	June 11	3	3%	3 p.c. Con. Deb.	72½—74½	55—57	..
130,000	,,	,,	10	10%	10 p.c. Bonds	..	..	..
258,740	,,	Mar. 12	5	3½%	Hastings & St. L. 3½ p.c.	87—89	48—53	..
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16¾	7¾—8½	..
86,600	—	—	—	9%	Hornsey 7 p.c.	..	115—125	..
181,000	Stk.	Mar. 12	7½	7%	Ilford A and C.	151—154	92—97	92½—92½
65,780	,,	,,	6⅔	5 5/9%	Do. B	115—118	72—77	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	65—68	..
4,940,000	,,	May 14	9	4½%	Imperial Continental	150—160	89—92	89—91
1,235,000	,,	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,242	,,	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	82—87	..
2,498,905	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A	211—213	81—82	..
					{ B	146—148		
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	70—72	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4¼—4⅝	3¾—4	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	88—98*	97¾
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	7⅛—8	7⅝—7¾
1,875,892	Stk.	July 29	4½	4½%	Newcastle&Gatsh'dCon.	98½—99½	71½—72	..
529,705	,,	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	61—63	..
55,940	10	Feb. 26	7/14/0	7%	North Middlesex 7 p.c.	14—15	9¼—10½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	104—106	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	2—3	..
60,000	50	Feb. 26	13	12%	Portsea, Island B	128—131	83—88	..
100,000	50	,,	12	11%	Do. C	118—121	73—78	..
52,000	50	,,	10	9%	Do. D	..	..	61¼—61½
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	2½—2⅝	46/—46/8
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4½—5	2⅝—3½	59/4½—62/6
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	78—80	..
—	—	—	—	4%	Do. ,, ,, 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	59—64	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	7¼—8*	..
125,000	50	July 1	5	5%	5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	..	..
209,984	,,	,,	10	10%	Do. B	222—224	180—184	..
523 500	,,	,,	10	10%	Do. C	220—222	..	..
90,000	10	May 28	9	6/-	South African.	10½—11½	8¼—9½	..
6,609,895	Stk.	Feb. 10	5/4/0	46/8	South Met. 4 p.c. Ord.	111—113	72—74	72½—74
—	—	—	—	—	Do. Pref.	—	—	95¼—95¾
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	55—57	56—56½
224,820	,,	Feb. 26	8½	7½%	South Shields Con. Stk.	157—159	137—139	..
962,795	,,	,,	6	4⅝%	S'th Suburb'n Ord. 5 p.c.	114—116	75—77	75⅝—76½
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	75—77	..
135,000	—	—	—	4⅝%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	86—88	..
647,740	,,	May 14	5	5%	Southampton Ord.	99—102	75—77	..
120,000	,,	Feb. 12	7½	5½%	Tottenham District { A 5 p.c.	135—138	92—97	..
782,275	,,	,,	6	4%	B 3½ p.c.	115—117	66—71	..
181,255	,,	June 26	4	4%	4 p.c. Deb.	87—89	63—65	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109½	89—91	..
					Wandsworth, Wimbledon, and Epsom—			
90,000	,,	Feb. 26	8⅔	72/6	Wandsworth A 5 p.c.	151—156	112—117	..
255,636	,,	,,	6½	57/6	Do. B 3½ p.c.	129—134	97—99	..
108,075	,,	,,	5/17/3	50/9	Do. C 3½ p.c.	110—115	84—89	..
352,000	,,	,,	6½	51/3	Wimbledon 5 p.c.	117—122	85—90	..
98,000	,,	,,	6⅔	57/6	Epsom 5 p.c.	121—126	98—98	..
88,416	,,	June 26	3	3%	3 p.c. Deb. Stk.	66—69	50—53	..

* Ex Div.

Ownership of the Fakenham Gas-Works.—The share capital and debentures of the Fakenham Gas and Coke Company, Ltd., have been acquired by Mr. Worthington Church. Further capital outlay was necessary to improve the works; and the Directors, after carefully going into the matter, came to the conclusion that it would be in the interests of the shareholders to dispose of the undertaking to someone in a position to make the required outlay. An offer to purchase the shares at £5 each, provided all the holders agreed to sell, was made by Mr. Worthington Church (who is the owner of several gas-works in East Anglia); and the shareholders have followed the advice of the Directors that they should accept his offer.

Labour Troubles at Gainsborough.—The labour troubles in connection with the Gainsborough Gas-Works still continue. Despite the award of the Ministry of Labour and the intervention of the Ministry of Munitions, numbers of stokers have handed in their notices and left their employment. The results are the restriction of gas output and reduced pressure, which caused important firms to communicate with the Ministry of Munitions. At the last meeting of the Committee, it was stated that a stoker whose release from the army had been secured by the Council, and whose wages had been made up by them during the whole of the time he had been with the forces, had also handed in his notice within three days of receiving his discharge from the army. Female labour has been employed where possible, and more is to be obtained. It has been decided to make immediate application for the gas-works to be controlled by the Government.

The Present Position of Chemistry.—Presiding at a meeting of teachers at the Regent Street Polytechnic, Prof. Armstrong declared that the present position of chemistry in this country was deplorable, owing to Government ignorance and indifference. The Board of Trade had advisedly and of set purpose, it would seem, put all scientific advice aside, and had taken measures which had not only proved a failure, but had actually retarded the development of the dye-stuff industry. The meeting was addressed by Prof. Pope, who said that Germany prepared for war by the establishment of a huge chemical industry, which was built-up about the coal-tar industry, and then exporting a very large proportion of the world's requirements of coal-tar colours and pharmaceutical and photographic products. This success was achieved in spite of the fact that this country at one time possessed the whole of the heavy chemical industry of the world. This country formerly produced practically all the nitric and sulphuric acids and the greater part of the alkali used throughout the world. It had, however, been taken from us as the result of the foresight and the exploitation of scientific ability which Germany had shown.

The Doncaster Gas Committee have resolved that a letter of thanks and appreciation be sent to each of the volunteers who rendered assistance at the gas-works during the recent strike.

The Kendal Gas Committee have decided to provide gas for motor vehicles at 5d. per 100 c.ft.

A failure of the electricity service took place in Glasgow, due to a 9000-H.P. alternator at the Port Dundas Power Station causing a fire in the high-tension switchboard. The failure was confined to the north side of the river.

The Burton-on-Trent Corporation Gas Committee are to charge for gas for motor-cars 4d. per 100 c.ft. net cash at the gas-works, with an extra 1s. charged for every car dealt with before 7 a.m. or after 5 p.m. on Mondays to Fridays, and before 7 a.m. or after 1 p.m. on Saturdays.

The Gas Light and Coke Company have intimated that as from the 1st inst. they will be unable to supply coke used for heating, cooking, and domestic purposes in quantities exceeding 3 cwt., unless it has been previously requisitioned on the official form issued by the Board of Trade.

Batley Corporation Gas-Works employees' wages are to be advanced, as from July 1. The stokers, blacksmiths, meter-repairers, fitters, &c., are to receive 10s. per week above pre-war rates; and the wages of some labourers are to be advanced to 8½d. per hour, and others 7d. Boiler-men and engine-men are to have an increase of ½d. per hour.

The Gas Light and Coke Company have unfortunately to chronicle, in the current issue of the "Co-Partners' Magazine," another loss to their fleet, by the torpedoing on Aug. 18, while carrying a cargo of coal for Beckton, of the s.s. "Ardens." The donkeyman was killed, and a fireman severely injured, by the explosion. The boat was purchased by the Company in March last year.

Messrs. Brotherton-Ratcliffe & Co., Ltd., of No. 4, Fenchurch Avenue, London, E.C. 3, merchants, importers, and exporters of chemicals, have increased their capital to £50,000 from the 11th of June this year. In one of our previous issues, we notified that Messrs. Brotherton-Ratcliffe & Co. had turned their concern into a limited liability company; and we have just been advised of the increase in capital.

Messrs. Fletcher, Russell, & Co., Ltd., of Warrington, are issuing a new gas-fire booklet in which (though the pamphlet is not quite so comprehensive as previous issues, owing to the cost and difficulty of obtaining suitable paper) the most popular patterns are shown. There are also illustrations and particulars of several new designs just introduced—the "Don," "Devon," "Orford," and "Glow" series and "Rosella" fires. The two first-named patterns are a continuation of the well-known "D" series; and the "Orford" and "Glow" patterns are of the inset type of fire. In addition, there is a gas-heated radiator pamphlet, as these appliances are not shown in the fire booklet.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINEER AND MANAGER. Portrush Gas Company. Applications by Oct. 17.
CHIEF CLERK (Water and Gas Company). No. 6363.
JUNIOR WORKS ASSISTANT. No. 6362.
CLERK. East Grinstead Gas and Water Company.
WORKING FOREMAN. No. 6356.
LEADING STOKER. Abertillery Gas-Works.

Plant, &c. (Second Hand), for Sale.

EXHAUSTER AND ENGINES. Llanelly Gas Company.

Patent Licence.

GAS MANTLES. Haseltine, Lake, and Co., 28, Southampton Buildings, W.C.

TENDERS FOR

Coal.

ALDERSHOT GAS, &c., COMPANY. Tenders by Oct. 20.
HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD. Tenders by Oct. 15.

Resetting Retorts, &c.

SPALDING GAS DEPARTMENT. Tenders by Oct. 15.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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BENZOL PLANTS FOR GAS-WORKS.
BAGLEY, MILLS, & Co., Ltd., 92, Victoria Street, Westminster, S.W., invite inquiries from all gas-works making 75 million cubic feet and upwards per annum.
See illustrated Advertisement Feb. 20, p. III. of Centre.

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W. FISH,
Secretary.

Offices: Victoria Road,
Aldershot.
Oct. 3, 1917.

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(GAS DEPARTMENT.)

TENDERS are invited by the above Council for the RE-SETTING of Two Beds of Six RETORTS, from the Beds of the bottom Retorts; also for Cutting out and Re-lining the two Furnaces, and Cleaning out the Flues and Washing same out with Fire-Clay Mixture, the Contractor to find all skilled Labour, and Supply the following MATERIALS: Twelve Retorts (of approved make), 23 in. × 16 in. Oval ⌂ pattern, 10 ft. long over all, Sight Boxes and Plugs, Retort Bolts and Nuts, necessary Silica Tiles, Bricks, and Cement Clay for Combustion Chamber, &c.

Tenders to be sent to the undersigned by Oct. 15, 1917, undertaking to complete the work within three weeks after the acceptance of their Tender.

The Council do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained of the Manager, Gas-Works, Spalding.

H. H. HARVEY,
Clerk to the Spalding U.D.C.

Spalding,
Oct. 4, 1917.

HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD.

THE Gas Board invite Tenders for the Supply and Delivery of 2000 Tons of Screened GAS COAL and NUTS during the Year ending Sept. 30, 1918.

Particulars and Forms of Tender may be obtained on Application to Mr. T. H. Nield, Gas Engineer, Carlton Street, Hebden Bridge.

Sealed Tenders, endorsed "Tenders for Coal," to be Delivered to me on or before Monday, Oct. 15, 1917.

R. CRABTREE,
Clerk.

Gas Offices,
Carlton Street,
Hebden Bridge,
Sept. 25, 1917.

THE Proprietors of the Patent No. 683 of 1915, for "IMPROVEMENTS IN APPARATUS FOR THE MANUFACTURE OF INCANDESCENT GAS-MANTLES," are desirous of entering into arrangements, by way of LICENCE and otherwise, on Reasonable Terms, for the purpose of Exploiting the same and ensuring its full development and practical working in this country.

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